TECHNICAL INSTRUCTION
S.7

Studio Equipment Type B

BRITISH BROADCASTING CORPORATION

ENGINEERING DIVISION

TECHNICAL INSTRUCTION
S. 7

Studio Equipment Type B

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CONTENTS

ILLUSTRATIONS IN TEXT

PART I: GENERAL

PART II: CIRCUITS

DIAGRAMS AT END

STUDIO EQUIPMENT TYPE B

PART I: GENERAL

SECTION 1.1
INTRODUCTION

The Type B Studio Equipment design supersedes that of the Type A Equipment introduced in 1946; it provides more facilities, and in particular a larger number of microphone channels. Much of the apparatus has been miniaturised, and to make the design adaptable to the requirements of different studios and also facilitate manufacture, the unit method of construction has been fully used.

The three main groups of equipment provided are:

Mark I: For talks and discussion studios,
Mark II: For general purpose studios,
Mark III: For very large variety studios where an audience is present.

In this Instruction, the basic or standard arrangements are necessarily the ones described, although the provision for possible variations is a feature of the design.

Every set of equipment includes:

1. Studio Control Desk,
2. Studio Apparatus Bay,
3. Power Supply Cabinet.

In addition, each set of Mark II equipment includes a common source and cue selection cabinet, while the Mark III equipment, which is larger, has separate source selection and cue selection cabinets.

Every set of equipment further includes at least one outside source telephone relay panel. (Section 2.2.)

The programme chain of the Type B Equipment differs from that of the Type A in many respects, although the monitoring circuits are very similar.

Some new features are:

(i) Two amplifiers only are employed between a source and the studio output, the circuits between these amplifiers being unbalanced.
(ii) Source selection for the various fader channels is made at low level.
(iii) Two group controls are provided.
(iv) Two effects units are provided, built into two of the channels.
(v) The output from the gram bank may be divided between two channels.
(vi) Acoustic (i.e., loudspeaker) effects can be provided from grams.
(vii) On the Mark II (or General Purpose) equipment nine fader channels are normally available.
(viii) Provision is made for accepting a number of outside sources, complete with control telephone, cue programme and prefade facilities.

The above list is typical, although not all these features are provided on the Mark I equipment, since in a talks studio only certain of them are likely to be required. By contrast, on the Mark III equipment, provision is made for the accommodation of further additional features as desired.

The equipments at Bush House, London, differ in a number of minor respects from those installed elsewhere. Most of the differences are mentioned in the main body of the text and noted on the drawings at the end of this Instruction. Three special microphone circuits peculiar to Bush House are described in Section 2.7.

SECTION 1.2

MARK II EQUIPMENT: STUDIO CONTROL DESK SCD/8

General Description

The studio control desk consists of an oak table in front of a long pedestal which accommodates the controls and technical equipment. (Figs. 1.2.1 and 1.2.2.)

The table top, which is faced with a laminated plastic, slopes down very slightly away from the operator. This feature permits the controls on the pedestal to be mounted as low as possible for operating convenience. The arrangement also allows the table to be made with a flat top and avoids the use of a central well. Scripts and musical scores may therefore be laid flat.

Two telephones, one at either end, are sunk flush with the table top. The left-hand telephone is for direct communication with the control room, while the right-hand one is for direct communication with outside sources. These telephones are connected to the pedestal via plugs and sockets at the right-hand end.

Two prefade listening jacks are recessed deeply in conical holes in the front edge of the desk so that the headphone plugs are protected from damage. The prefade connection to the pedestal is made via a further plug-and-socket connector, mounted in this instance at the left-hand end.

The table is fixed to the floor by four screws and is not dependent on the pedestal for support; it may therefore easily be moved away from the desk should complete access to the pedestal be desired for any work more comprehensive than normal maintenance. (Fig. 1.2.3.)

The pedestal which carries the controls is divided horizontally by a projecting cantilever beam which is flush with the table top. Above this level the space is divided into three by a large centre panel flanked by two smaller side panels, all of which are hinged on the front projection of the cantilever. These panels, which slope slightly backwards from the vertical, are normally secured by screws. When swung face downwards to rest on the table the equipment at the rear of the the panels is completely exposed for maintenance. When open a batten of wood should be placed behind the exposed base-plates to ensure that the assemblies do not fall back into position.

Both the main centre panel and the main side panels consist of a skeleton framework to which a number of smaller panels are screwed. Although there is a preferred arrangement of these panels, it is possible to reduce or increase the number of equipped panels fitted where necessary. The main centre panel can accommodate 16 panels, while the main right-hand panel holds 6 panels and the main left-hand panel 4 standard panels and one double-sized one.

Attached at right-angles to the rear of the base-plate of the main centre panel are two chassis each carrying a relay-and-attenuator unit, the left-hand unit being concerned with direct-sound group switching and the right-hand one with echo group switching. Mounted directly on the baseplate are a main gain control by-pass relay (MGB), and an output switching relay (AER) for the acoustic effects gram fader. Beneath a smaller chassis behind the main left-hand panel are mounted two effects units Type EU/1A, while above this chassis are echo hybrid coils.

The lower part of the pedestal is fronted by two panels which, when removed, give access to apparatus within. Housed in the lower left-hand part of the pedestal are 10 cable-termination blocks and a unit comprising low-level switching relays. In the lower right-hand part of the pedestal are three relay boxes, Types RLB/47A, RLB/48C and RLB/49, together with a tone-and-buzzer unit. Desks with serial numbers 101 to 106 and 114 (all at Bush House) are equipped with an RLB/48A instead of RLB/48C, and have in addition a box containing series resistors for outside-source telephone calling lamps.

Since access to all parts of the pedestal is available from the front, the control desk may be installed with its back or either of its ends adjacent to the cubicle/studio window.

A separate talkback microphone is used, mounted as convenient for the individual installation.

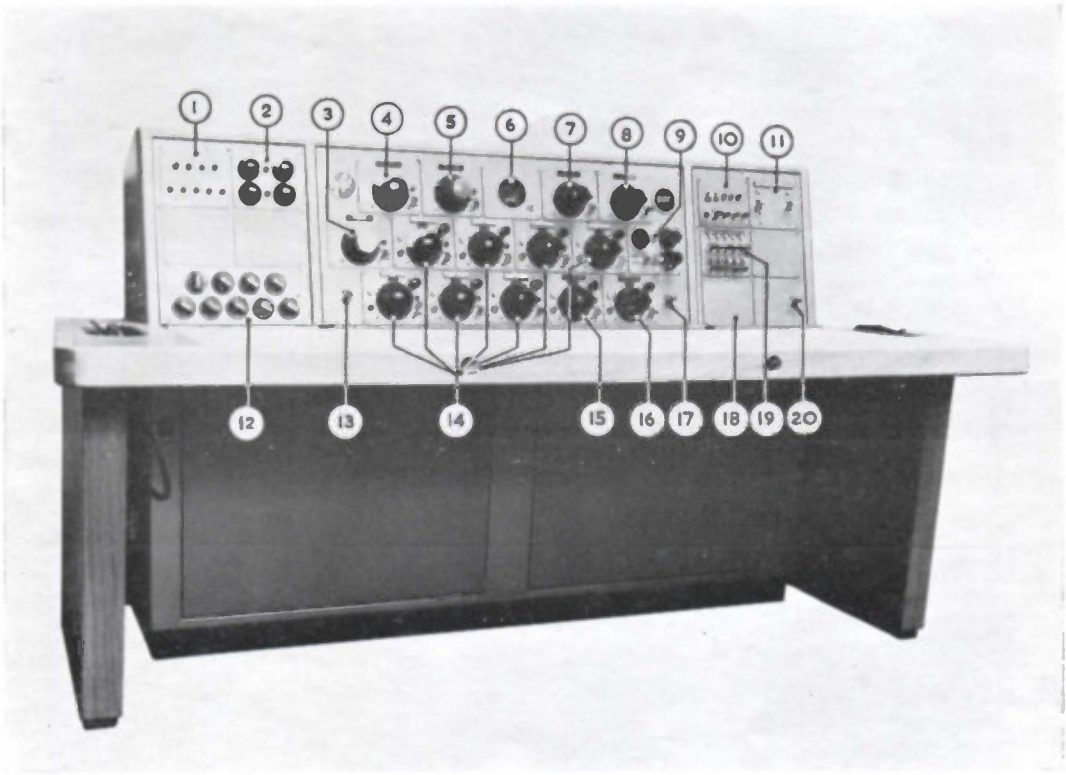


Fig. 1.2.1. Desk SCD/8: General View

1. Public address panel
2. Effects control panel
3. Main fader panel
4. Left group fader panel
5. Right group fader panel
6. P.P.M. panel
7. Narrator's fader panel
8. Echo fader panel
9. Monitor panel
10. Apparatus control panel
11. Reproduce/Record remote-starting panel
12. Echo mixture switch panel
13. Studio talkback key
14. Microphone channel fader panels
15. Mic/Gram fader panel
16. Gram/Acoustic Effects Gram fader panel
17. Clean feed key
18. Cue programme switching panel (see text)
19. Outside sources panel
20. Clean-feed talkback and studio talkback keys (see text)

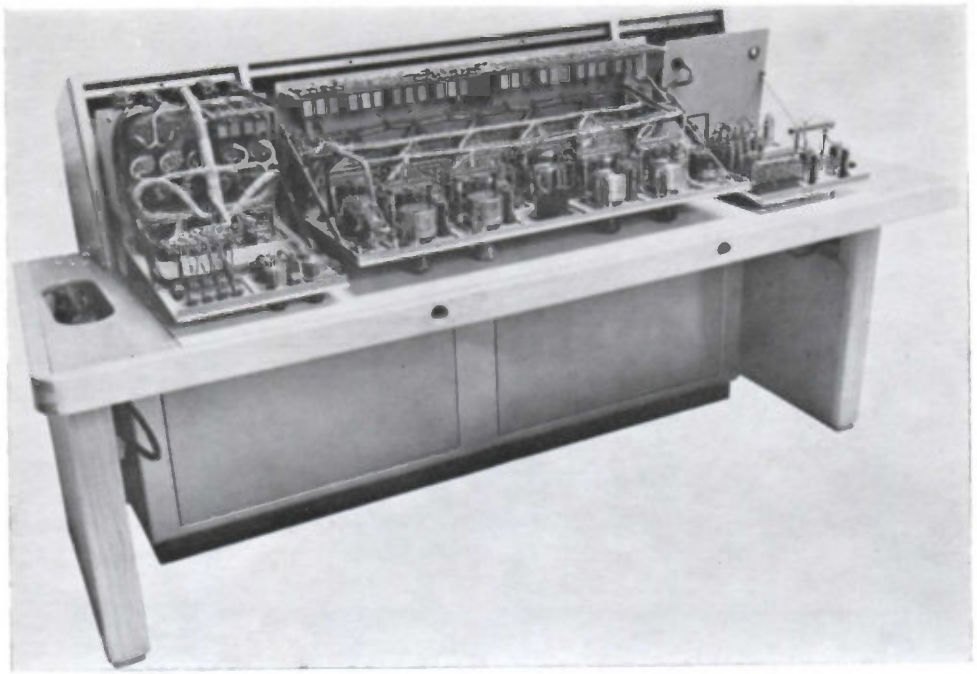


Fig. 1.2.2. Desk SCD/8 with Control Panels in Maintenance Position

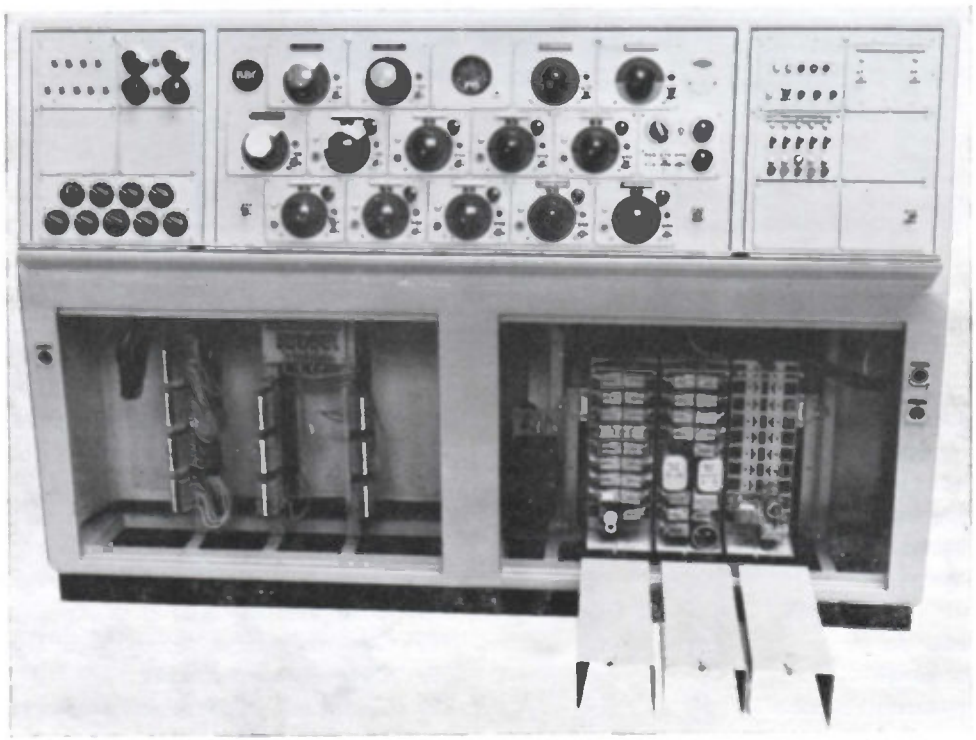


Fig. 1.2.3. Desk SCD/8 Control Pedestal Showing Interior of Lower Portion

Main Control Panels (Fig. 1.2.1)

Centre Main Panel

This comprises the following functional panels, which may be identified by the appropriate number references given below and appearing in Fig. 1.2.1.

Main fader panel (3),
Echo fader panel (8),
Left group fader panel (4),
Right group fader panel (5),
Narrator's fader panel (7),
Seven microphone channel fader panels (14),
Mic/Gram fader panel (15),
Gram/Acoustic Effects Gram fader panel (16),
P.P.M. panel (6),
Monitor panel (9).

Mounted directly on the main panel at the bottom left-hand and right-hand corners respectively are:

Studio talkback key (13),
Clean-feed key (17).

Left-hand Main Panel

Five sub-panel units can be accommodated on this main panel. Normally only 2 are equipped, and they are:

Echo mixture switch panel (12),
Effects control panel (2).

The remaining panels are normally blank, but equipped panels may be substituted for blanks if called for; Fig. 1.2.1. shows the following panel in position:

Public address panel (1).

The two unequipped panels below panels (1) and (2) have tag-blocks at their rear wired to allow them to be used if necessary to control additional microphone channels; these channels would be numbered 10 and 11.

Right-hand Main Panel

This panel carries 6 small panels, one of which is normally blank, while the others are:

Apparatus control panel (10),
Reproduce/Record remote-starting panel (11),
Outside sources panel (19),
Cue programme switching panel (18) not shown in Fig. 1.2.1,
Clean-feed talkback and studio talkback keys (20).
(Fig. 1.2.1 shows only the studio talkback key, but on a standard desk a clean-feed talkback key is mounted on the left of this.)

The panel to the right of (19) is normally unequipped, but is wired as far as its rear tag-block to accommodate an additional microphone channel (No. 12). It may, however, be used to extend the number of outside source controls, in which case panel (20) may carry cue programme switching keys as well as talkback keys. Wiring for these would have to be provided on installation.

NOTE:—The lists of sub-panels given above together with the indicated variations are intended as a general guide, but in practice further slight alterations may be made in accordance with the special requirements of any given installation.

Standard Panel Units

Main Fader Panel

This panel carries the main control fader, Type PB/11M/1, together with a master cue-light key, controlling all wall and stand cue-lights, and an associated green indicator-lamp. The fader is fitted with a white knob and has the usual black mask, which uncovers a 90-degree sector of a 265½-degree scale progressively as the fader is rotated to increase programme volume.

The PB/11M/1 is an unbalanced 600/600-ohm bridged-T attenuator having 32 studs with a loss ranging from zero on stud 31 to infinity on stud 0. The loss per stud between intermediate studs is:

Studs	1–4	4–8	8–11	11–31
Loss	5 dB	4 dB	3 dB	2 dB

An off-normal change-over contact operating between studs 0 and 1 is fitted to the fader but not wired beyond the main fader panel terminal block.

Echo Fader Panel

This panel carries the main echo fader, Type PB/10M/1, together with an echo cut-off key. The fader is fitted with a black knob, and a mask uncovering a 180-degree scale as the fader is moved to increase echo volume.

The PB/10M/1 is an unbalanced 600/600-ohm bridged-T attenuator having 22 studs with a loss ranging from zero on stud 21 to infinity on stud 0. The loss per stud between intermediate studs is:

Studs	1–2	2–4	4–6	6–10	10–21
Loss	8 dB	6 dB	4 dB	3 dB	2 dB

An off-normal change-over contact operating between studs 0 and 1 is fitted to the fader but not wired beyond the fader panel terminal block.

Left and Right Group Fader Panels

These panels each carry a group fader, Type PBB/3M/1, together with a group cue-light key and associated green indicator-lamp. Each fader

comprises two ganged sections, controlling the group direct and echo outputs respectively. The left-hand group fader is fitted with a red knob and the right-hand group fader with a blue knob; each carries a mask uncovering a 154¾-degree scale as the fader is moved to increase group volume. The cue-light keys control the stand cue-lights appropriate to the microphone channels selected to the group.

The PBB/3M/1 is a double unbalanced 600/600-ohm bridged-T attenuator, each section having 19 studs with a loss ranging from zero on stud 18 to infinity on stud 0. The loss per stud between intermediate studs is:

Studs	1–3	3–4	4–5	5–7	7–10	10–18
Loss	8 dB	6 dB	5 dB	4 dB	3 dB	2 dB

An off-normal change-over contact operating between studs 0 and 1 is wired into the loudspeaker cut-off circuit. (Section 1.5.)

Its off-normal contact is wired into the loudspeaker cut-off circuit. The cue-light key on any of the microphone channel fader panels may be connected via the wall-mounted cue-selection panel to any one of the portable cue-lights, or any up to the total number of channel cue keys may be connected to any one cue-light.

On the left-hand side of each panel the photographs show a toggle-switch and indicator-lamp. These are not fitted to any production-model desk.

Mic/Gram Fader Panel (*Fig.* 1.2.4.)

This panel is equipped in the same manner as the microphone fader panels except for the addition of a toggle-switch and a white indicator-lamp. With the toggle-switch in the *up* position this channel operates as a normal microphone channel; with the switch in the *down* position two relays (NGA, NGB) operate, and the channel takes its input from section 'B' of the grams. Operation of the toggle-switch also transfers the cue control key from the studio cue-light to the cue-light above the gram turntables.

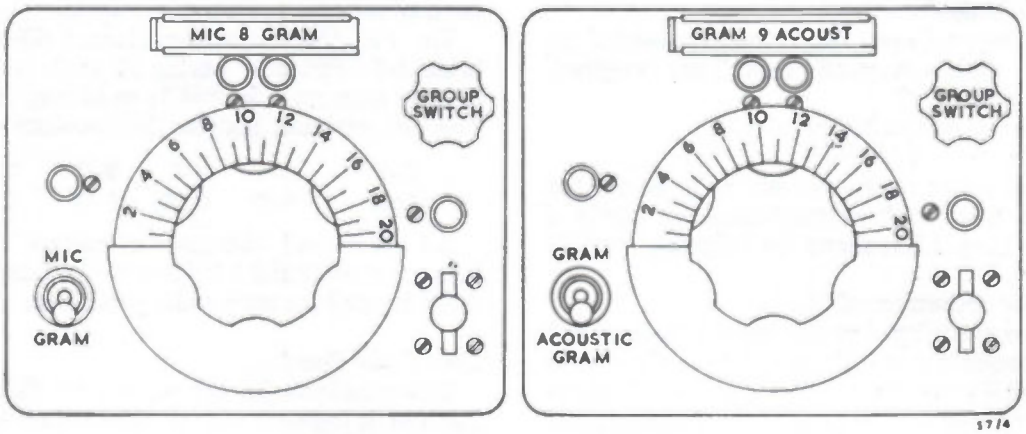


Fig. 1.2.4. Gram Fader Panels

Narrator's Fader Panel

This panel carries the narrator's microphone fader, Type PB/10M/1, together with the relevant cue-light key and green indicator-lamp. The PB/10M/1 is similar to the main echo fader already described, except that its off-normal contact is wired into the loudspeaker cut-off circuit. (Section 1.5.)

Microphone Channel Fader Panels

These seven panels each carry a PB/10M/1 fader, together with a cue-light key and green indicator-lamp; also fitted is a group-selection switch with a red (left group) and a blue (right group) indicator-lamp. The PB/10M/1 has been described in connection with the echo fader panel.

Gram/Acoustic Effects Gram Fader Panel (*Fig.* 1.2.4)

This panel is equipped in exactly the same way as the mic-gram fader panel. Normally the outputs of both 'A' and 'B' sections of the grams are controlled by the gram/acoustic effects gram fader, but operation of the toggle-switch on the mic/gram fader panel leaves only the 'A' output of the gram-bank routed through the gram/acoustic effects gram fader. The toggle-switch on the gram/acoustic effects gram fader panel itself operates a

relay (AER) which diverts the output of the fader from the main programme chain to a high-quality loudspeaker in the studio. The output of this loudspeaker is picked up be a microphone and mixed in with the rest of the programme. The object of this arrangement is to allow the effects to be given the acoustical quality of the studio and the correct auditory perspective in relation to the artists; a further advantage is that it enables the artists to hear the effects so that they can deliver their lines accordingly. The cue-light key on the panel operates the green light over the gram-bank.

P.P.M. Panel

This panel carries a P.P.M. instrument with pre-set variable resistance *Zero* adjustment. It is fed from an MNA/3 amplifier on the studio apparatus bay.

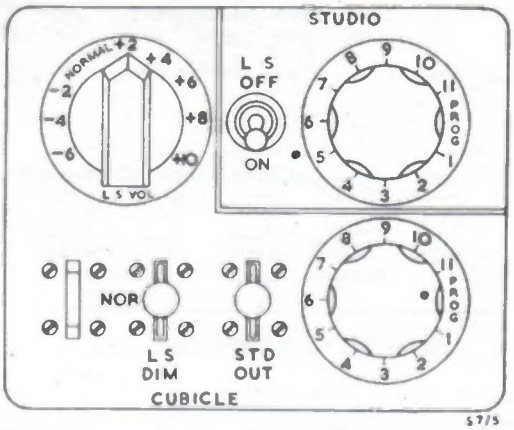


Fig. 1.2.5. Monitor Panel

Monitor Panel (*Fig.* 1.2.5)

This panel has two groups of controls, one for the studio loudspeaker and the other for the cubicle loudspeaker. The controls for the studio loud-speaker comprise a programme-selector switch together with a loudspeaker cut-off switch. The controls for the cubicle loudspeaker consist of a programme-selector switch, a volume-setting switch, a loudspeaker-dimming key and another key which allows the direct output of the studio to be switched rapidly to the cubicle loudspeaker when the programme-selector switch is set to a position other than the studio output.

Positions 1 to 7 on the programme-selector switches are used for ring-main feeds, position 8 normally gives the output of the studio, and position 9 is reserved as usual for feeding any special programme. Position 10 provides a monitoring feed from a recording circuit when one is engaged by the studio. Exceptionally, at Bush House, London, position 11 gives the studio output, leaving position 8 for use with an additional ring-main feed.

Public Address Panel

This panel is not fitted to the standard Mark II desk, but is mentioned as an example of one of the special features which can be provided when specially called for.

The panel, when fitted, carried switches connecting feeds from the individual microphone channels to public address loudspeakers in the studio. These loudspeakers are used, for example, to allow a studio audience to hear crooners who would otherwise be inaudible above an orchestra. The switches permit the feed from any given microphone channel to be routed through the P.A. system.

Effects Control Panel (*Fig.* 1.2.6)

This panel carries the controls for two effects units EU/1A, which may be wired into any two channels, usually channel 7 and channel 8, the latter being the mic/gram position. Each EU/1A unit consists of a variable low-pass filter and a variable high-pass filter in series, the response curves and circuit being given in Section 2.4.

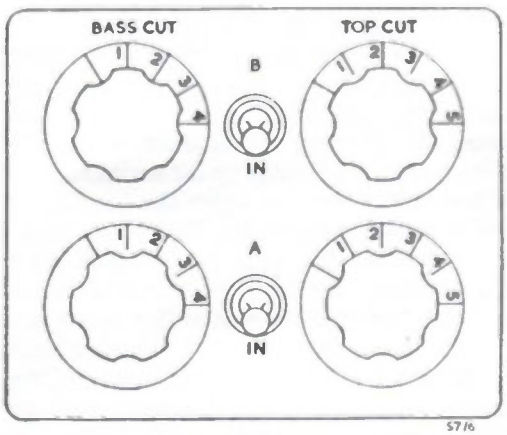


Fig. 1.2.6. Effects Control Panel

Echo Switch Panel

This double-width panel carries nine echo-mixture switches, Type BTT/3Y/1, arranged in two rows corresponding to the two rows of channel faders on the central main control panel. Each

switch has nine positions, marked 0 to 8, providing control of the ratio of direct sound to echo on a channel. The significance of the settings is as follows:

0. Direct sound only,
1. 0 dB loss in direct path and 12 dB loss in echo path,
2. 0 db loss in direct path and 7·5 dB loss in echo path,
3. 0 dB loss in direct path and 3·5 dB loss in echo path,
4. 0 dB loss in both paths,
5. 3·5 dB loss in direct path and 0 dB loss in echo path,
6. 7·5 dB loss in direct path and 0 dB loss in echo path,
7. 12 dB loss in direct path and 0 dB loss in echo path,
8. Echo only.

NOTE:—On desks SCD/8 with serial numbers from 101 to 115 inclusive, the echo-mixture switches are Type PTT/2Y1, each switch having five positions, marked 0 to 4. The significance of the settings of the PTT/2Y1 is:

0. Direct sound only,
1. 0 dB loss in direct path and 12 dB loss in echo path,
2. 0 dB loss in direct path and 8 dB loss in echo path,
3. 0 dB loss in both paths,
4. Echo only.

Apparatus Control Panel (*Fig.* 1.2.7)

At the top of this panel are mounted a group of four mechanically interlocked apparatus-control push-buttons, labelled *Tone*, *Reh.*, *Trans*, and *Off* respectively. Pushing any of these buttons except the one marked *Off* brings up the mains and battery power-supply relays and lights the blue *Rehearsal* warning lamps for the studio. Pushing the *Tone* button also applies 1-kc/s tone at —64 dB to the input of the main amplifier, from the output of which tone at zero level can then be sent to line, while pushing the *Reh.* button switches the talkback circuits to their rehearsal condition. The *Trans.* button, by contrast, has no additional functions, and the *Off* button merely serves as a mechanical release to the other three. (Note that the operation of the studio red light from a continuity or control position does not switch the equipment into the transmission condition as happened with Type-A equipment.)

Also on the apparatus control panel are the control-room buzzer push, the *Studio Red Light* key and three pull-switches; these switches, marked *Main Gain By-pass*, *Main Amp. C/O* and *Mon. Amp. By-pass*, are intended for use under fault conditions.

The *Main Gain By-pass* switch, when pulled out, causes the main gain control potentiometer to be replaced by a fixed-loss pad. The *Main Amp. C/O* switch causes the ' main ' and ' transmission talkback ' amplifiers to be interchanged.

The MNA/3 monitor amplifier works at zero input and output levels, and the *Mon. Amp. By-pass* switch simply removes this amplifier from the chain. Note however that when the amplifier is by-passed, there is no feed to the studio cubicle P.P.M., and control of level has therefore to be carried out elsewhere.

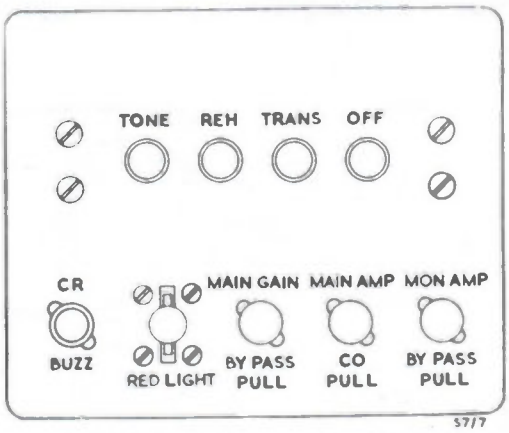


Fig. 1.2.7. Apparatus Control Panel

Reproduce/Record Remote-starting Panel

This is used to start a remotely located magnetic-tape machine, thus facilitating the reproduction of recorded material into the programme originating in the studio, or enabling the programme itself to be recorded.

The panel is provided with separate *Start* keys for reproducing and for recording. A white lamp above the appropriate key lights up as an indication that a suitable magnetic-tape machine is tied to the panel circuits and is correctly set up for a remote start.

The remote starting of a *recording* machine from the panel also brings up the studio red light, which is arranged to come on about 2 seconds after power is applied to the machine. The intention is to ensure a wow-free start to the recording when circumstances make it desirable to use the red light as a starting cue for the artists in the studio.

Outside Source Panel (*Fig.* 1.2.8)

This panel provides prefade listening and control telephone facilities for use with programme sources located outside the studio. The panel is drilled and wired for five outside sources, but is normally equipped for four only. Where it is likely that more than four sources may be needed it is usual to provide a second panel, and to increase the number of sets of outside source equipment to six, eight or ten.

The prefade keys, of the pull-out locking type, are mounted at the bottom of the panel. When any one of the keys is pulled out a relay is operated which transfers the desk headphones from the normal monitoring feed to the source that is being prefaded. If more than one key is out at a time, the first one to be moved takes priority and the others are made inoperative by a guard circuit.

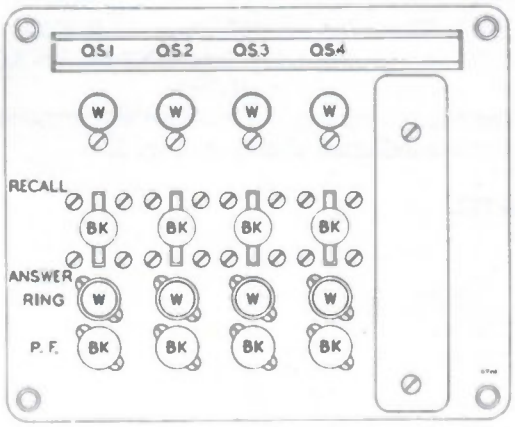


Fig. 1.2.8. Outside Source Panel

The outside-source telephone circuits are associated with the right-hand one of the two handsets. The telephone is routed via the E.M.X. when an outside source is connected, but is not supervised by the E.M.X. operator unless his attention is specially called.

The music and control lines connecting with the outside sources required for a programme are selected by the main control room, but once these circuits are set up they are handled by the studio operator. Note that the telephone circuits are not routed via the wall-mounted source-selection panel.

Each outside-source circuit is provided with a white *Calling* lamp, an *Answer/Recall* lever-key and a *Ring* push-button. The *Answer/Recall* key is locking in the down (*Answer*) position, but non-locking in the up (*Recall*) position. (The *Ring* push-button is also non-locking.) The *Answer* position of the key allows the studio to speak with the outside source, whereas the *Recall* position is used if it is necessary to call the attention of the E.M.X. operator.

An incoming call causes the telephone buzzer to start sounding and lights the white *Calling* lamp associated with the circuit. When the handset on the right-hand side of the desk is lifted and the *Answer* key is operated, the *Calling* lamp goes out and the buzzer stops sounding. Conversation can then proceed.

If the call is not answered by the studio within some 20 seconds of its inception, the buzzer is switched off, leaving the *Calling* lamp still alight. In these circumstances, the next time the source rings the studio the attention of the E.M.X. is called. This special circuit condition is cancelled as soon as the studio answers the source.

Cue Programme Switching Panel

This panel carries keys used to switch cue programme to the control lines connecting with an outside source during such time as the line is not being used for telephone communication. The keys are of the normal lever type, and when depressed, remain in the operated position. The cue programme is cut off automatically during telephone calls.

The panel has room for five keys, but is normally equipped with four. Where it is likely that more than four outside sources may be wanted a second adjacent panel is used to increase the number of keys to six, eight or ten. For reasons connected with the accommodation of the associated relay sets, it is not economic to fit an odd number of keys.

Irrespective of whether or not additional cue programme keys are fitted, the second panel carries the *Clean Feed Talkback* key and one of the two parallel-connected *Studio Talkback* keys, the other one of which is mounted in the lower left-hand corner of the main centre panel.

Clean Feed Key

The *Clean Feed* key is mounted in the lower right-hand corner of the main centre panel. The key has a bright metal-plated handle fitted with a locking-sleeve which has to be pulled out to enable the key to be moved between the central (non-operated) position and the up or down (operated) positions. The *up* position of the key is labelled *C.F.* + *T.T.B.* (clean feed + transmission talkback) while the *down* position is merely labelled *Clean Feed*

The key is used for setting up the conditions necessary for programmes requiring the use of a 'clean feed', e.g., two-way programmes, further details of which are given in Sections 1.5 and 2.5.

Control Room Telephone

The left-hand telephone is used for communication with the control room and is brought up to the E.M.X. where one is installed. At Bush House, London, the E.M.X. telephone is also the 'destination' telephone, which is connected automatically to a continuity or control desk or a recording room, when this point selects the studio as a source.

Relay Boxes

Relay boxes RLB/47A, RLB/48C (or 48A) and RLB/49 are arranged to jack into hinged mounting panels which can be swung forward giving access to the rear wiring.

Relay box RLB/47A houses relays LSO, TTO, OCT, OCM, TW, CDM, SLS, NLS, MNA, RH, PFA, PFB, PFC, PFD, TWL, LSA, and DHP.

Relay box RLB/48C houses relays RC, LC, RD, LD, GC, GO, RO, RDB, RDA, LCF, RTC, AL, RDC and WP. This box also contains telephone transformers, a choke, capacitors and other components used with the telephones and red-light circuits.

Relay box RLB/48A, used at Bush House, contains a P relay as well as the relays normally housed in box RLB/48C.

Relay box RLB/49 fitted on a standard desk is unequipped and is provided merely to maintain the springs of the relay jacks in a clean condition. If more than the standard provision of four outside source circuits is required, box RLB/49 gives way to one of the other boxes in the 49 series, which contain various numbers of outside source P.F.L. relays as follows:

RLB/49A: 2 relays (PFE—PFF)
RLB/49B: 4 relays (PFE—PFH),
RLB/49C: 6 relays (PFE—PFK*).

If any other additional relays for special modifications are needed, they are also normally fitted in the RLB/49. Thus, for example, box RLB/49X1 has an LSC and an AM relay, box 49X2 has an AGC relay, and box 49X3 has all three.

The relays housed in the low-level unit mentioned earlier are indicated clearly on Fig. 1.

*There is no relay coded PFI.

SECTION 1.3

MARK II EQUIPMENT: STUDIO APPARATUS BAY SAB/1

Construction and Assembly

This 19-inch bay carries all necessary amplifiers for the studio and cubicle circuits, together with the mains units and distribution panels also required.

The front of the bay only is equipped, the apparatus provided being as follows:

2 Amplifier-mounting Panels AP/1A,
1 Mains Unit MU/51 (2 sections),
1 Supply Distribution Panel SDP/1,
1 Mains Distribution Panel MDP/5 (or MDP/4),
1 Mains Unit MU/51 (2 sections).

Amplifier-mounting panel AP/1A and mains unit MU/51 are described in Instruction S.3.

Fig. 1.3.1 shows the layout of an SAB/1 using a Type-12 bay framework, which is made from 5½-in. bent-up channeling. Bays with serial numbers from 101 to 106 inclusive are on the older Type-9 framework constructed of rolled-steel channeling measuring 3½ in. from front to back, and these bays also use an MDP/4 instead of an MDP/5.

Amplifier-mounting Panels AP/1A

The upper one of the two AP/1A panels on the bay carries ten AMC/5 amplifiers (Instruction S.3), while the lower panel carries nine AMC/5 amplifiers and one MNA/3 amplifier (Instruction S.3). Each panel is also equipped with a spare AMC/5 and a switch unit which enables a defective amplifier to be bridged by the spare. The wiring to the switch unit on the lower panel is so modified that it is not possible for the MNA/3 to be bridged by the spare AMC/5.

The circuit functions of individual amplifiers are marked on Fig. 1.3.1. (See also Section 1.5.) Where there is no P.A. equipment, amplifier 13 is available as a reserve; amplifier 14 is an additional reserve AMC/5; so is amplifier 15, but the latter is designated for use in place of the normal external echo microphone amplifier where required. The input to amplifier 20 (the MNA/3) is wired via a break-jack at the bottom of the lower panel. To the right of the break-jack is a further jack which is used to supply zero-level 1-kc/s test-tone for lining up the P.P.M. operated by the MNA/3.

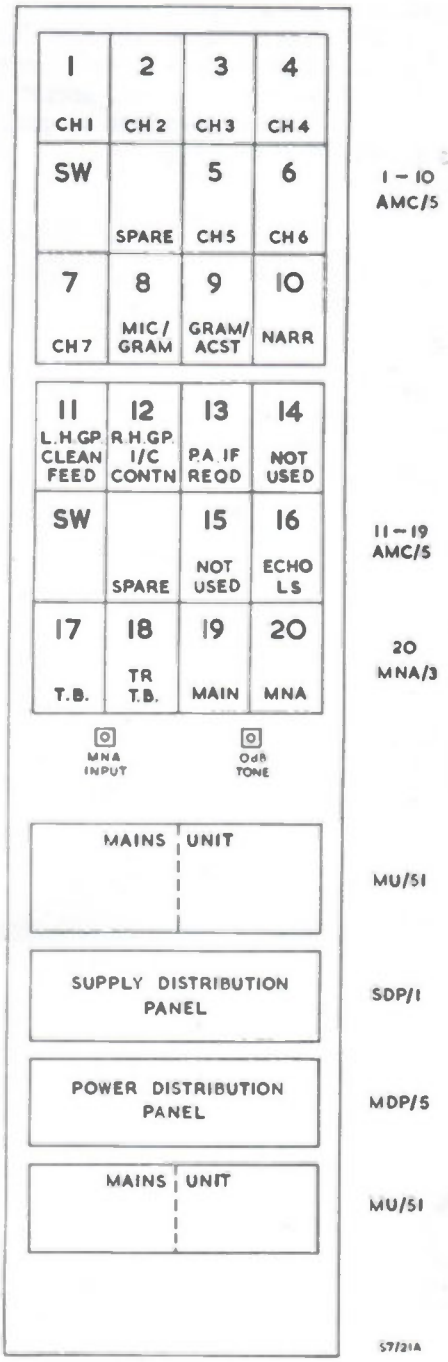


Fig. 1.3.1. Studio Apparatus Bay SAB/1

Supply Distribution Panel SDP/1

The panel SDP/1 is fitted with two groups of three sockets behind a protecting front cover. Of these six sockets, four are connected to the outputs of the four MU/51 sections and the remaining two sockets are left unwired.

A cable from the upper AP/1A is plugged to one socket of the SDP/1 and a cable from the lower AP/1A is plugged to another socket, leaving the remaining two wired sockets to provide reserve supplies.

Mains Distribution Panel MDP/4

The panel MDP/4 used with the Type-9 bay framework is fitted with four 3-pin 13-amp mains sockets. These sockets are plugged to the inputs of the four sections composing the two mains units MU/51.

Mains Distribution Panel MDP/5

The panel MDP/5 used with the Type-12 framework is fitted with six fuse links, two of which are spare.

SECTION 1.4

MARK II EQUIPMENT: WALL-MOUNTING CABINETS

Power Supply Cabinet PSC/2 (Fig. 1.4.1)

This wall-mounted cabinet is 32 in. wide, 15 in. high and about 6½ in. deep overall. The cabinet is divided into five compartments which, from left to right (Fig. 1.4.1) are used to house:

1. 50-volt d.c. equipment,
2. Signal-lamp mains-supply relays,
3. Mains-voltage distribution board,
4. Mains-supply circuit-breakers,
5. Mains-supply control equipment.

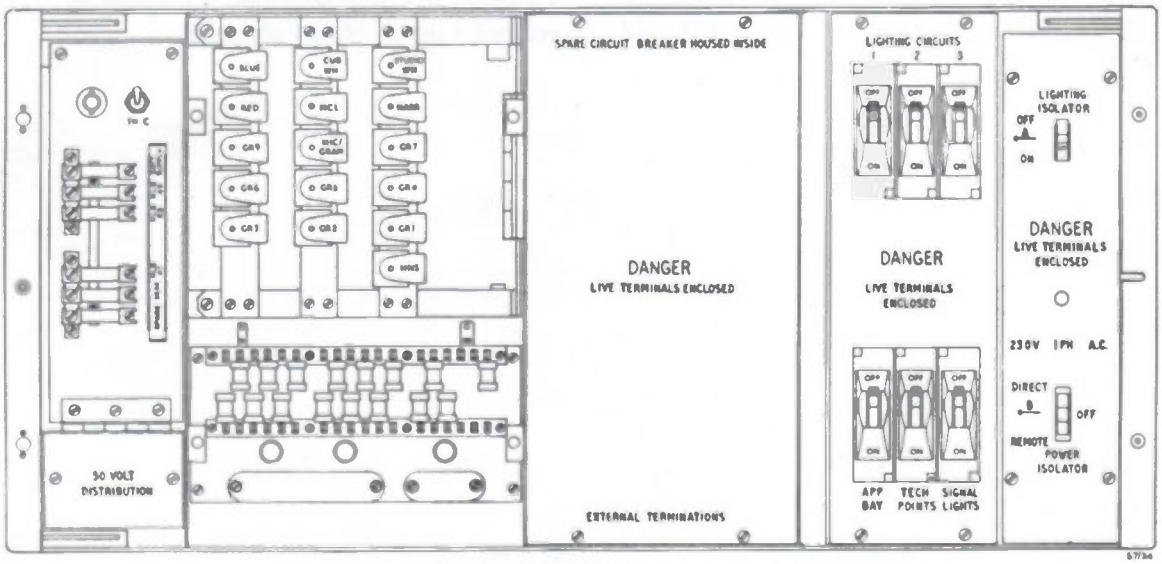


Fig. 1.4.1. Power Supply Cabinet PSC/2: Layout with Doors Removed

A common door is provided for the three compartments on the left, and a further door for the two compartments on the right. Near the top of the left-hand compartment is an indicator-lamp, which lights to show that the 50-volt supply is *on*. Close to the lamp is a double-pole switch, controlling the supply to a fuse-panel below. Also mounted near the top of the compartment is a fuse-alarm buzzer, connected via a resistor to the fuse-alarm bar. Behind a small screw-on cover-plate at the bottom of the compartment is the distribution-block through which the 50-volt supply is conveyed to the control desk and to the source and cue-selection cabinet.

The relay compartment contains the cue-light relays, together with relays for the studio red light and for the usual blue *Rehearsal* light and white *Telephone* lights; also mounted here is a mains-supply remote-control relay. Below the relays are their associated anti-click circuit components, and at the bottom of the compartment is a Grelco block for desk cue-light key connections.

The adjacent distribution board compartment is used to terminate the mains-supply circuits for all equipment in the studio and cubicle, and to house a spare (15-amp) circuit-breaker.

The next compartment houses six miniature circuit-breakers. Of these, three with instantaneous action control the lighting supplies via wall-switches, and three with thermally delayed action control the technical supplies; one technical circuit-breaker is used for cue-lamps, one for the studio apparatus bay and one for the gram desks and loudspeakers. The final compartment on the right, which carries a phase disk on the front panel, contains a master mains switch for the studio lighting and a *Direct/Remote* mains switch for technical supplies. The *Direct/Remote* switch, when

thrown to *Direct*, connects the incoming mains to the technical-supplies circuit-breakers directly; when thrown to *Remote*, the switch connects the mains to the circuit-breakers via the mains-supply remote-control relay, which is operated from the *Tone*, *Transmission*, *Rehearsal* and *Off* push-buttons on the control desk.

The circuit details of the PSC/2 are described in Section 2.1.

Source and Cue Selection Cabinet SCSC/1

This cabinet is equipped with a source selection panel and a cue selection panel.

Source Selection Panel

The source selection panel forming the right-hand half of the cabinet carries a three-row jackfield, above which are two relays, NGA and NGB (Figs. 1 and 3), operated by the *Mic./Gram* toggle-switch on the desk and controlling the inputs to the two gram channels. The local microphone sources and a 1-kc/s test-tone appear on the jackfield at low level; the outside sources are brought up at both low and high levels, the latter for listening purposes. Two spare 12-dB loss-pads are also provided.

Cue Selection Panel

The cue selection panel forming the left-hand half of the cabinet carries rotary-type cue-light selector switches for the microphone channels. Mounted above the switches is a relay, CLC (Fig. 3), operated by the *Mic./Gram* toggle-switch on the desk; this relay selects the appropriate cue-light circuit (either *Mic.* or *Gram*) for operation via the relays on the power supply panel.

SECTION 1.5

MARK II EQUIPMENT: THE PROGRAMME CHAIN

General (Fig. 1)

The programme chain of the Mark II equipment is shown schematically in Fig. 1. In this drawing, for reasons of clarity and size, no wiring information appears. Schematic diagrams drawn to a larger size and bearing all necessary wiring information for maintenance purposes should however be available in the station files. Except where special diagrams exist for a given station, Drawings No. PID 4968.9.1K and 9.2D should be supplied.

Input Section (Figs. 1.5.1 to 1.5.5)

Provision is made for eight normal studio microphone points, together with a narrator's microphone and also an emergency microphone the output of which is wired straight through to the control room without any intervening jackfields, amplifiers or studio controls. The outputs of the eight standard microphone circuits appear on jacks on the source selection panel (Figs. 1.5.1 and 1.5.2), together with up to 10 (but normally four) outside source

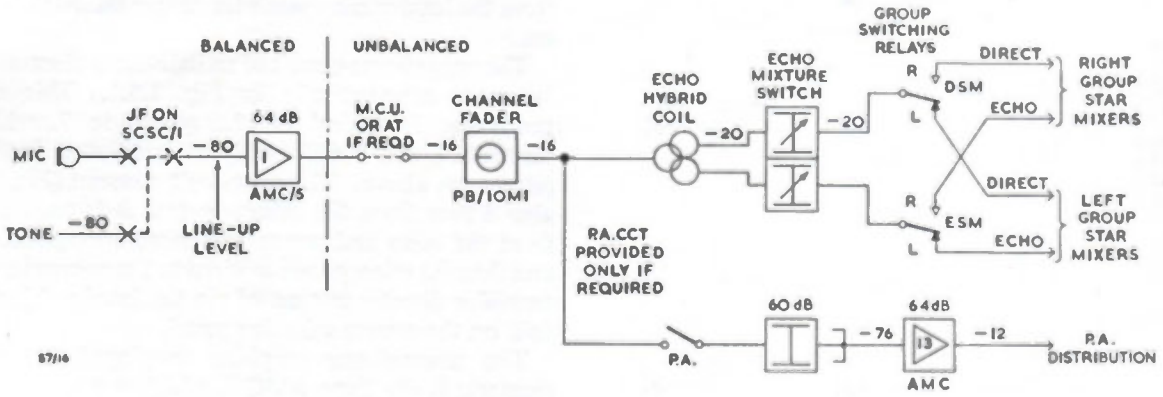


Fig. 1.5.1. Microphone Channel

The basic components of the Mark II equipment programme chain are as follows:

(a) Input circuits from microphone, grams and lines.
(b) Channel amplifiers and faders, followed by *direct* and *echo* group switching.
(c) Group faders, echo circuits and a combining network which brings together the output of the narrator's microphone and the outputs of the direct and echo chains.
(d) Main gain control, main amplifier and studio output line, this last being fed with programme at zero volume from a source impedance of 600 ohms.
(e) Monitoring chain.
(f) Talkback circuit, interconnected with the main amplifying chain.

lines, which are brought out both at high level for listening and at low level via 73-dB loss-pads. Tapped off on the high-level side are prefade-listening feeds to the desk headphone jacks via the P.F.L. relays and relay DHP.

The source selection panel carries two spare 12-dB loss-pads and is also supplied with a feed of 1-kc/s line-up tone at a level of −80 dB. (At Bush House, −73 dB.) In Fig. 1, and elsewhere, the levels marked are approximate only, and refer to a signal at −80 dB applied to a channel-input jack. When microphones are connected instead of tone, there is normally some 6 to 8 dB in hand, which has to be taken up on the channel or group faders and allows some measure of control to be exercised in the balancing of individual microphone outputs. At Bush House additional

attenuation is introduced after the group faders as shown in Fig. 1, and the microphone and group faders are normally worked flat out.

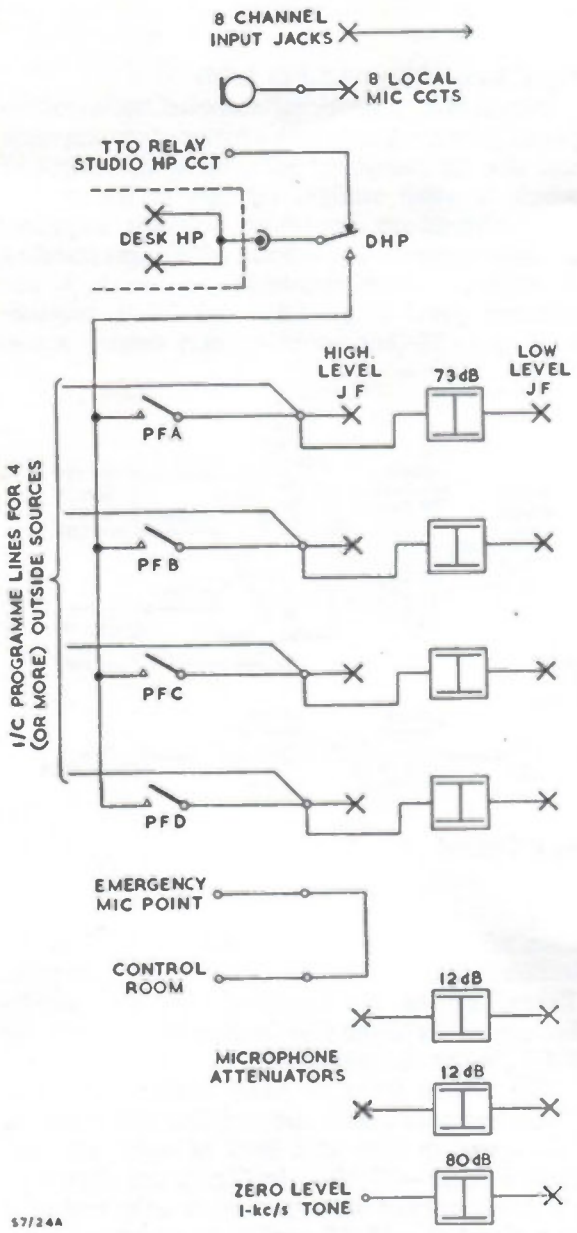


Fig. 1.5.2. SCSC/1 Source Selection Panel: Programme Circuits

Input jacks for eight channels are normally provided on the source selection panel. Seven channels are intended for use exclusively with studio microphones or outside lines, while the eighth channel has an input circuit switchable between the source selection panel input jack and the grams. (Fig. 1.5.3.) The gram banks in the studio comprise two groups, A and B, which can either be switched to the inputs of channels 9 and 8 respectively, or else combined on channel 9 leaving channel 8 free for use with a microphone or outside line. The output of channel 8 is tied to the group selection switching system, while that of channel 9 may be routed either to the group switching system or to the acoustic gram-effects loudspeaker. (See Section 1.2, under the headings *Mic./Gram Fader Panel* and *Gram/Acoustic Effects Gram Fader Panel*, and Section 1.4, *Source Selection Panel*.)

At Bush House there is no special loudspeaker for acoustic-gram effects, the normal studio loudspeaker being used as shown in Fig. 1.5.3(b). Relay AGC operates and cuts off the gram circuit from the loudspeaker while the studio talkback is in use.

The programme circuit of an individual channel is indicated schematically in Fig. 1.5.1. This arrangement is typical of channels 1 to 7, while channels 8 and 9 differ only as mentioned in the paragraph above. The narrator's channel (Fig. 1) also differs from the others in that it is excluded from the echo and group switching arrangements and that the microphone is wired to the microphone amplifier directly instead of via the low-level jackfield on the source selection panel.

The microphone amplifier employed for all channels is the Type AMC/5, which is a low-noise version of the GPA/4, and is described in Instruction S.3. Ten microphone amplifiers are required, one for each of the channels 1 to 9, and one for the narrator's channel. The amplifiers are mounted on the studio apparatus bay on the upper panel AP/1A, which carries a total of 11 AMC/5 amplifiers, one of which is spare. A rotary switch (Fig. 1.5.4) is provided to allow the spare amplifier to be switched into parallel with any one of the other 10, a muting key permitting the switch to be isolated during rotation. Once the spare amplifier is in parallel, the original amplifier may be withdrawn in the manner described in Instruction S.3, Section 21.

Each microphone amplifier is followed by a channel fader (Fig. 1.5.1) and (except in the narrator's channel) by an echo hybrid coil and echo-mixture switch. Details of echo-mixture settings are given in Section 1.2. The echo-mixture switch has two outputs, which are together normalled to the left group, but can be switched to the right

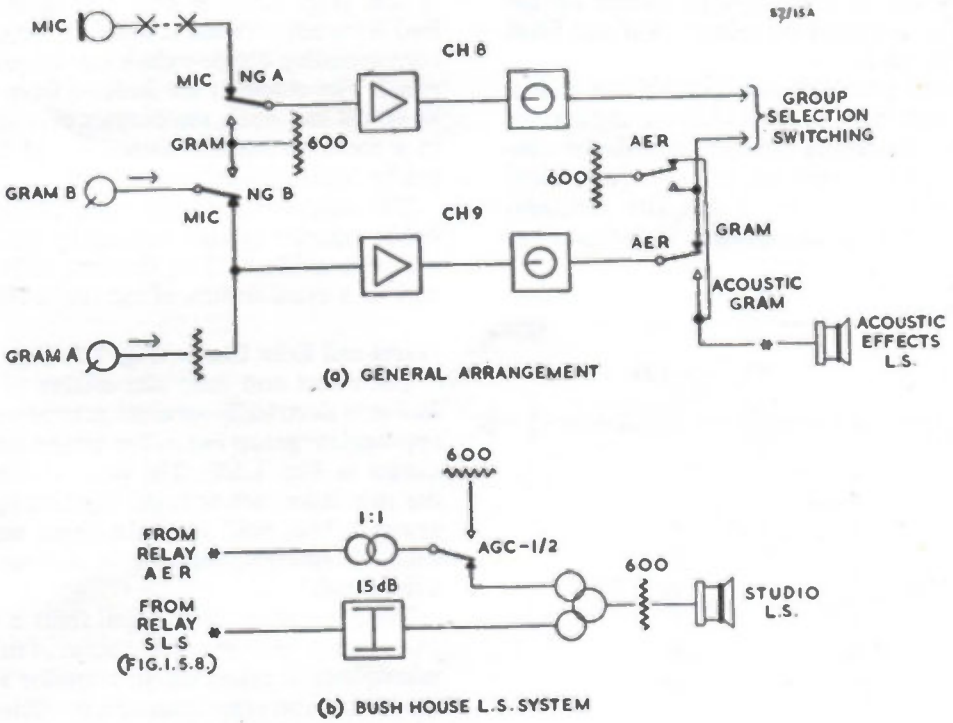


Fig. 1.5.3. Gram Fader Panels Switching

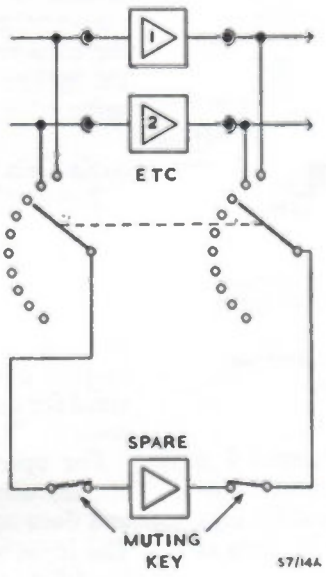


Fig. 1.5.4. Switch Unit of Amplifier-mounting Panel AP/1A

group by means of a rotary-type switch on the channel-fader panel and the relays DSM and ESM shown in Fig. 1.5.5.

Each group is provided with both a direct and an echo star mixer, each with an ultimate capacity of 12 channels. To ensure constant-impedance conditions, the inputs either not in use or not wired are terminated with 600 ohms. The constant-impedance switching arrangement is indicated in

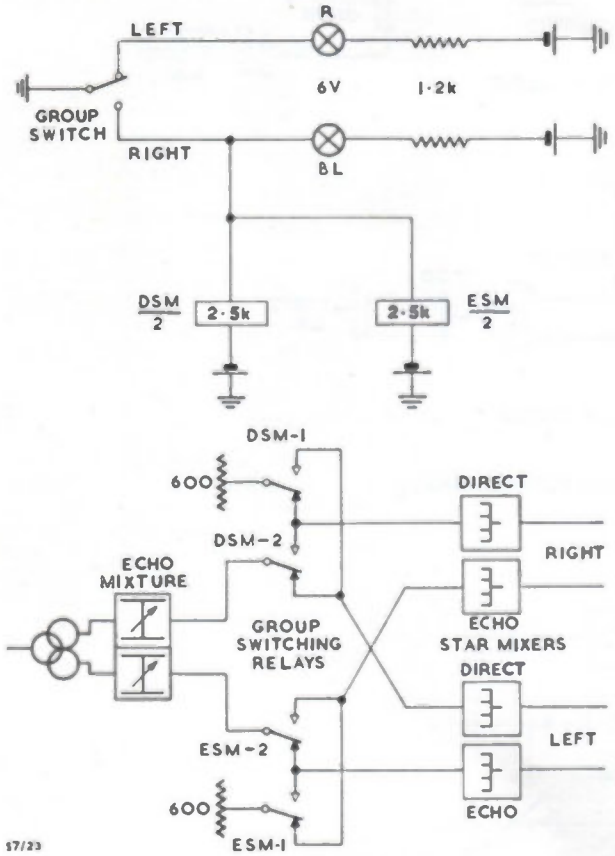


Fig. 1.5.5. Constant-Impedance Group-switching Arrangement (For each Channel)

the lower part of Fig. 1.5.5. When channel 9 is switched to the acoustic effects loudspeaker, its impedance as seen at the inputs of each of the four star mixers (Fig. 1.5.6.) is replaced by 600 ohms as shown in Figs. 1.5.3 and 1.5.5.

Between the channel fader and the echo hybrid coil is tapped off a feed to the public address system (Fig. 1.5.1) if one is installed. The P.A. feed from any channel is obtained by operating the corresponding toggle-switch on the public address panel. The channels are isolated from one another by 60-dB loss-pads, the outputs of which are taken to a common AMC/5 amplifier and thence to the public address distribution system.

The indications at present (May 1960) are that a public address system will rarely be installed for use with a Mark II equipment, although it may well be a usual feature of the Mark III.

Direct and Echo Chains (Fig. 1.5.6)

The direct and echo star mixers of each group feed into electrically-separate ganged sections of the appropriate group fader, the arrangement being as shown in Fig. 1.5.6. The direct-chain outputs of the two faders are brought together by means of a group hybrid coil, the echo-chain outputs being similarly brought together by means of another hybrid coil.

The echo group hybrid coil feeds a loudspeaker unit in an echo room. The output of the echo room microphone is taken via an amplifier and the echo cut-off key and echo fader to a combining network, where it is joined by the outputs from the direct-group hybrid coil and from the narrator's microphone channel. The echo fader is intended to be operated with about 6 dB in hand.

The particular echo room to be used in any given instance is selected in the control room. If the studio premises has no echo room, the output from the echo-group hybrid coil via amplifier No. 16 is fed by line to a loudspeaker in an echo room at some other premises.

Main Gain Control and Output Section (Fig. 1.5.7)

The combining network is followed by the main gain control shown in Fig. 1.5.7. The normal levels obtained at the input and output of this control when the complete programme chain is being lined up on tone supplied from the tone jack on the source selection panel are indicated on the diagram. A by-pass circuit incorporating a fixed pad is provided for use in the event of failure of the main gain control.

For operational purposes, tone sent to line is applied direct to the input of the main AMC/5, and does not pass through the main gain control. The input and output impedances of the AMC/5 amplifier are both 600 ohms, the studio output line being loaded at either the local or the control room end with a further 600 ohms.

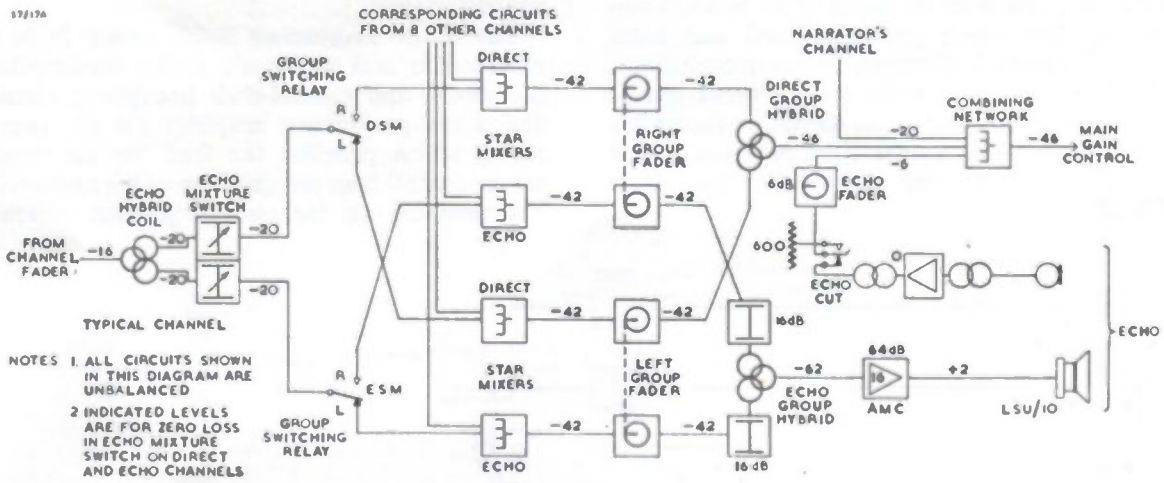


Fig. 1.5.6. Left and Right Group Circuits and Echo Channel

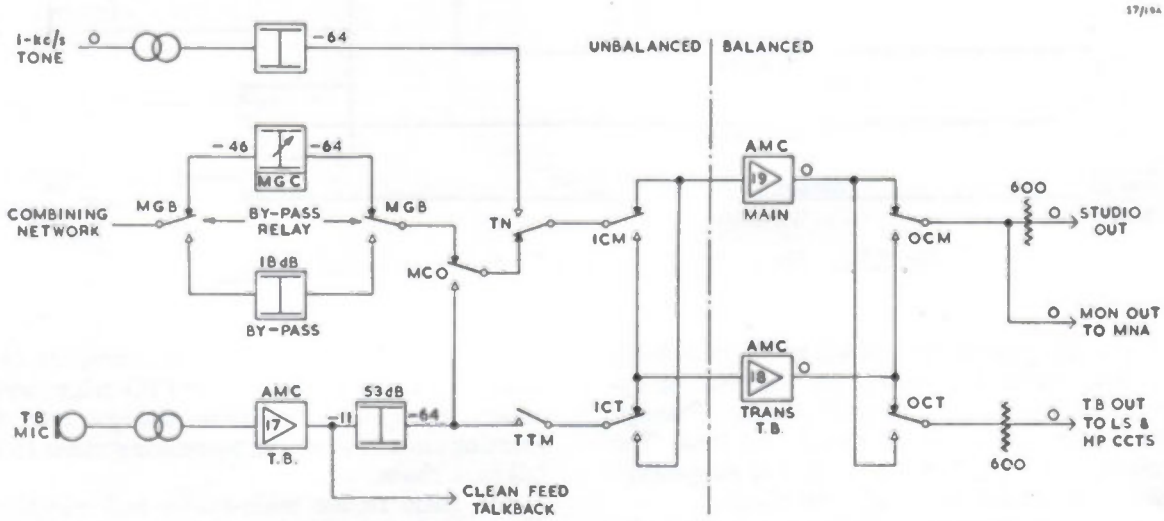


Fig. 1.5.7. Main Control Chain with Connections to Talkback Chain

Monitoring (Fig. 1.5.8)

In parallel with the studio output line from the main amplifier (No. 19) is a connection to the monitoring circuits shown in Fig. 1.5.8. Amplifier 19 output is taken to the input of an MNA/3 (Instruction S.3) which provides visual and aural monitoring feeds. To facilitate lining-up operations, the MNA/3 input is brought up on a break-jack at the bottom of the lower panel AP/1A on the SAB/1 bay; a further jack to the right provides a feed of 1-kc/s tone at the appropriate test level of 0 dB.

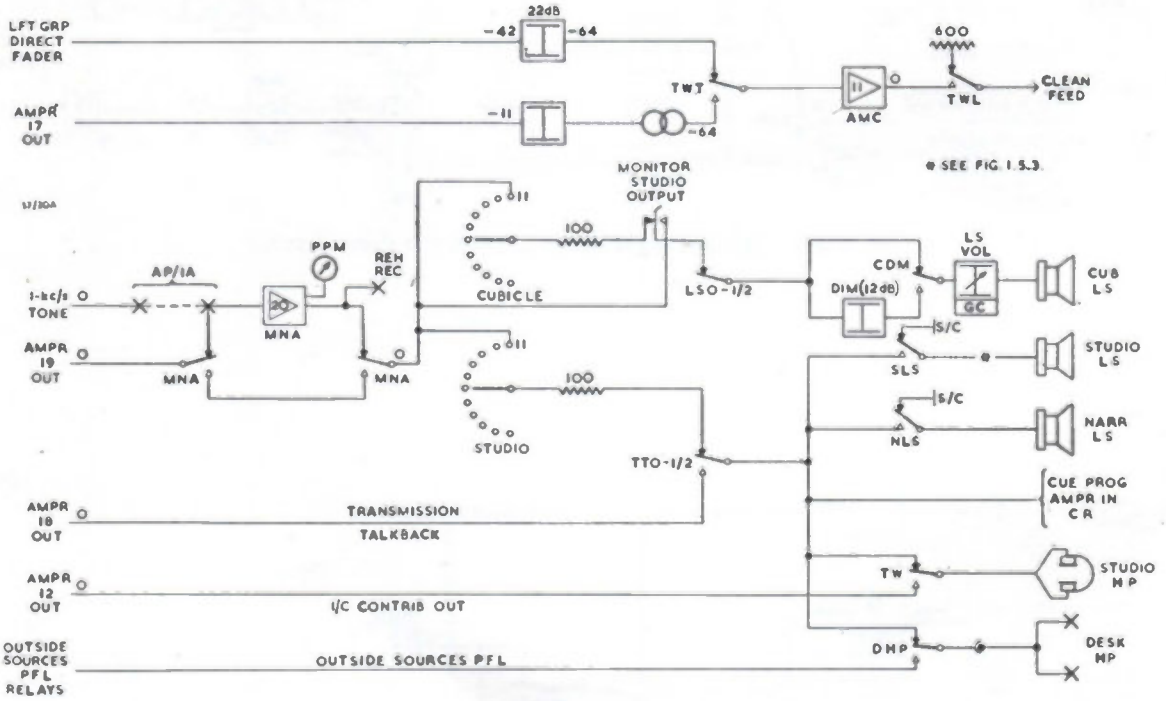


Fig. 1.5.8. Monitoring Circuit with Connections to Talkback Chain

The audio gain of the MNA/3 amplifier is 0 dB, and in the event of a fault it can therefore be by-passed via the contacts of the MNA relay, although with the loss of the visual monitoring feed. The audio output of the MNA/3 is taken to *Programme Select* switches for the cubicle and studio.

The cubicle *Programme Select* switch feeds the cubicle loudspeaker, via the contacts of cut-off and dim relays operated respectively by either *Studio Talkback* key and by the *Cubicle Loudspeaker Dim* key, or, except at Bush House, by the *Clean Feed Talkback* key. Mounted on the monitor sub-panel are two further controls included in the cubicle loudspeaker circuit. One of these is a key used to by-pass the *Programme Select* switch and listen directly on the MNA/3 output; the other is a volume control.

The *Studio Programme Select* switch feeds the main-studio and narrator's studio loudspeakers, the studio and control-desk headphone circuits, and a cue-programme amplifier (in the control room) which provides the feed for the outside source control lines on operation of the appropriate key mounted on the cue programme switching panel described in Section 1.2. The connection to all these circuits is made via the TTO relay, which under appropriate conditions changes over the listening circuits from the monitoring chain to the talkback chain.

The feeds to the main-studio and narrator's-studio loudspeakers are routed via the SLS relay and the NLS relay respectively. Off-normal contacts fitted to the channel and group faders ensure that either or both of these relays release and cut off the appropriate loudspeaker feed whenever a microphone in the main or narrator's studio is alive.

The *Studio L.S.* switch, when thrown to the *Off* position, causes the SLS and NLS relays to release and cut off the main and narrator's studio loudspeakers except under talkback conditions, even when the microphones of neither studio are alive.

The desk headphone circuit is routed via the DHP relay, by means of which the headphones are switched between the outside source P.F.L. circuits and the studio monitor circuit and talkback chains.

The subject of *Clean Feed Talkback* is dealt with on page 22.

Studio Talkback Arrangements (Fig. 1)

Different talkback arrangements are used under (a) rehearsal and (b) transmission conditions.

(a) Under the rehearsal condition, the output of the talkback microphone provided at the control desk is routed via the talkback amplifier (No. 17), the MCO relay and the main amplifier (No. 19) to the MNA amplifier (No. 20) and the studio and narrator's loudspeakers. To prevent howlback, the cubicle loudspeaker is cut off so long as the talkback key is depressed. At Bush House, the acoustic-gram effects circuit is cut from the studio loudspeaker to which it is normally connected via the contacts of AER when the *Gram/Acoustic Gram* switch is on *Acoustic Gram*. (Figs. 1.5.3(b) and 1.5.8.)

(b) Under the transmission condition, the talkback microphone output is routed via the talkback amplifier (No. 17), the transmission talkback amplifier (No. 18) and the TTO and TW relays to the studio headphones. The cubicle loudspeaker is dimmed and carries the programme output of the main amplifier (No. 19), but the studio and narrator's loudspeakers respectively are cut off by means of fader off-normal contacts if any of the main-studio microphones or the narrator's microphone is live.

Both under rehearsal and under transmission conditions, if the *Clean Feed* key is thrown, relay

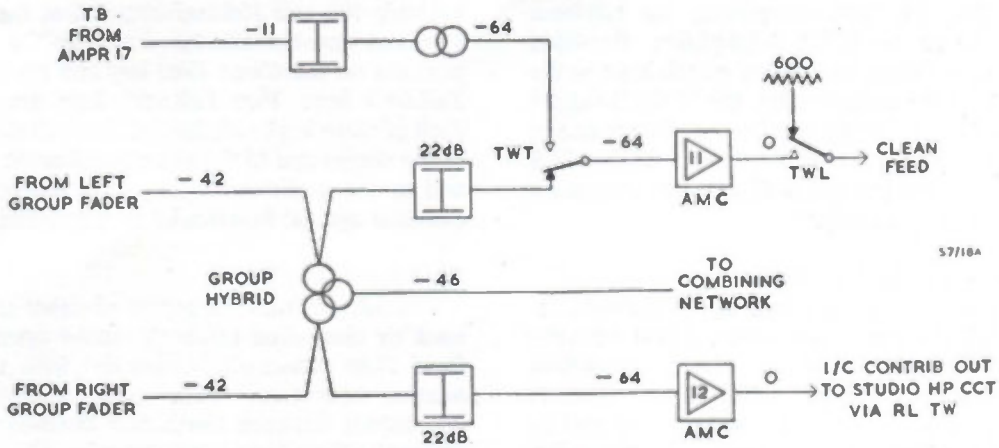


Fig. 1.5.9. Clean Feed Arrangements

Clean Feed Arrangements (Fig. 1)

The programme chain includes special arrangements for providing a clean feed of the local studio output for use in connection with two-way programmes or otherwise. Corresponding arrangements are included to allow the studio to listen to the incoming contribution alone and to permit talkback down the clean feed line.

It is intended that channels carrying local contributions shall be switched to the left-hand group fader, and an output from this is routed to the contacts of relay TWT, which normally remains unoperated and passes the group output to the clean feed line via the contacts of relay TWL. It is intended correspondingly that the channel carrying the incoming contribution shall be switched to the right-hand group fader, from which a listening output is routed to the studio headphone circuit via the contacts of relay TW.

When the *Clean Feed* key is thrown (either to *Clean Feed* or to *C.F. + T.T.B.*), relays TWL and TW operate, the latter restoring to normal, however, if a *Studio Talkback* key is thrown.

TW (Fig. 1) operates and the studio headphones are put onto the incoming contribution output line from the right-hand group fader via amplifier No. 12. Relay TW releases when either *Studio Talkback* key is thrown, making talkback to the studio available on headphones.

Rehearsal Talkback to Studio

When either *Studio Talkback* key is thrown, relays LSO, MCO, SLS and NLS operate. LSO cuts off the cubicle loudspeaker, while MCO connects the output of amplifier No. 17 to the input of amplifier No. 19, thus completing the talkback circuit as far as the MNA/3 amplifier. Provided that the studio *Programme Select* switch is set to the studio monitoring output point, the MNA/3 output passes via TTO-1/2 to the studio headphones and to control lines taking cue programme. Relays SLS and NLS connect the main-studio and narrator's loudspeakers respectively.

Transmission Talkback to Studio

When either *Studio Talkback* key is thrown, relays CDM, TTM and TTO operate. CDM dims the cubicle loudspeaker and TTM connects amplifiers No. 17 and 18 together, while TTO connects amplifier No. 18 to the studio headphones and to control lines taking cue programme. Transmission talkback is fed in addition to the studio or narrator's loudspeaker if the studio or narrator's microphones are all faded out at the appropriate channel or group faders.

Clean Feed Talkback

The action of the *Clean Feed Talkback* key depends upon the setting of the *Clean Feed* key. If the *Clean Feed* key is not operated, the *Clean Feed Talkback* key is ineffective, except for operating the CDM relay and thus dimming the cubicle loudspeaker. With the *Clean Feed* key in the *Clean Feed* position, the *Clean Feed Talkback* key merely operates relay CDM if the studio is switched to transmission, but operates relay TWT as well as CDM if the studio is switched to rehearsal; the operation of relay CDM dims the cubicle loudspeaker, while that of TWT connects the output of amplifier No. 17 to the input of amplifier No. 11 and thence via the contacts of TWL to the clean feed line. With the *Clean Feed* key in the *C.F. + T.T.B.* position, the *Clean Feed Talkback* key operates both when the studio is switched to rehearsal and when it is switched to transmission. The *Clean Feed Talkback* key may if necessary be operated at the same time as one of the *Studio Talkback* keys.

NOTE:—Desks Type SCD/8 with serial numbers between 101 and 106 inclusive (all at Bush House, London) were manufactured with no *C.F. + T.T.B.* position on the *Clean Feed* key and no *Clean Feed Talkback* key. Two *Talkback* keys are provided; each of these keys switches talkback simultaneously to the studio and to the clean feed line on rehearsal, and to the studio only (subject to the normal precautions against howlback) on transmission.

Send Tone Condition

Considered from the aspect of either studio talkback or clean-feed talkback circuit operation, the *Send Tone* condition is identical with the *Transmission* condition. (The only difference from *any* aspect between these two conditions is that under the *Send Tone* condition relay TN is operated whereas under the *Transmission* condition it is not.)

Main Amplifier Emergency Change-over

When the *Main Amplifier Change-over* key on the equipment control panel is pulled out, relays ICM, ICT, OCM and OCT operate. The relative circuit positions occupied by the main amplifier (No. 19) and the transmission talkback amplifier (No. 18) are thereby interchanged. Thus, if amplifier 19 should develop a fault on transmission, amplifier 18 can immediately be substituted; as soon as time permits, the faulty amplifier can then be bridged, withdrawn and replaced on the appropriate AP/1A panel.

SECTION 1.6

MARK I EQUIPMENT: STUDIO DESK, BAY AND CABINET

Introduction

The Mark I equipment consists essentially of:

Studio control desk SCD/9,
Studio apparatus bay SAB/2,
Power supply cabinet PSC/3.

No source and cue selection cabinet is provided, since the circuits which in the Mark II equipment were routed via this cabinet are here permanently wired to the fader panels for the individual microphones and outside source lines and the grams.

Apart from the question of source and cue selection, the Mark I equipment differs from the Mark II by accommodating a reduced number of microphones and outside sources and by having no group fading facilities or echo channels.

General Description

The desk consists of an oak table in front of a metal pedestal which accommodates the controls and technical equipment. Two telephones, one at either end, are mounted on the outsides of the legs below the level of the table. The right-hand telephone is for direct communication with outside sources, while the left-hand one is for direct communication with the control room. These telephones are connected with the pedestal via plugs and sockets at the right-hand end. Two prefade listening jacks are recessed deeply in conical holes in the front edge of the desk so that the headphone plugs are sunk out of harm's way. The prefade connection is made to the pedestal via a further plug-and-socket connector, mounted in this instance at the left-hand end.

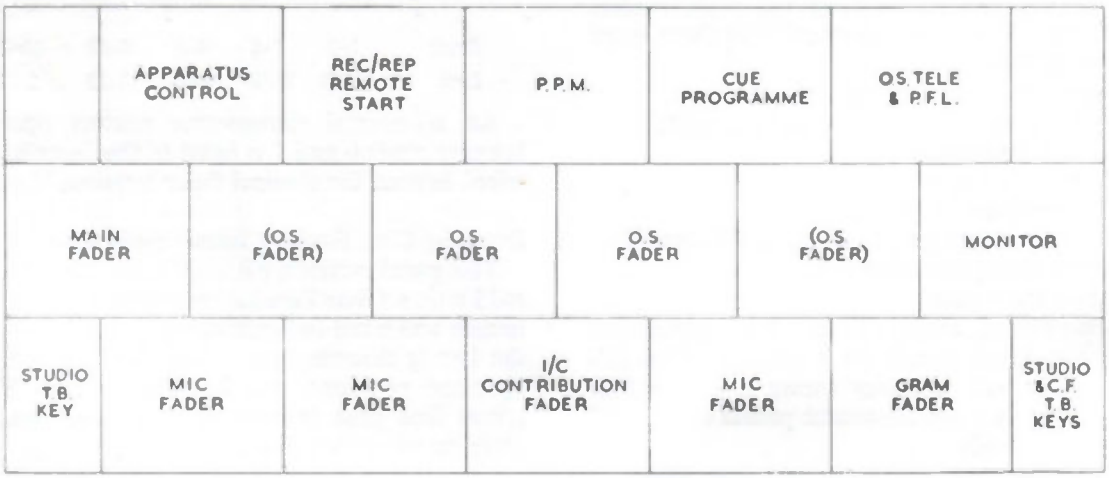


Fig. 1.6.1. Studio Control Desk SCD/9: Arrangement of Panels

Studio Control Desk SCD/9

Comparison with Desk SCD/8

Desk SCD/9 is similar in design to desk SCD/8 but has a narrower carcase carrying only one main control panel; this latter uses the same sized framework as the SCD/8 main centre panel, and is similarly capable of accommodating a maximum of 16 smaller panels. The lower part of the desk also contains similar apparatus to the SCD/8 except that only six cable-termination blocks are fitted instead of ten.

The pedestal carrying the controls is divided horizontally by a projecting cantilever beam which is flush with the table top. Above this level is mounted the main control panel, which is hinged on the front projection of the cantilever. The main control panel consists of a skeleton framework, to which the sixteen smaller panels are secured. Attached at right-angles to the lower rear of the main panel is a chassis baseplate carrying repeating-

coils, star mixers and two relays (MGB and TWT), together with minor items. The panel slopes slightly backwards from the vertical, and is normally held by screws but may be swung forward to rest face downwards on the table, so giving access to the equipment at the rear. While the panel is open, a wooden batten should be kept behind the baseplate to ensure that the assembly does not fall back into position.

Housed in the lower left-hand part of the pedestal are six cable-termination blocks and a low-level relay switching unit. In the lower right-hand part of the pedestal are three relay-boxes, Types RLB/47A, RLB/48C and RLB/49. (Desks with serial numbers 101 to 111 and 114 are equipped with relay boxes RLB/48A instead of 48C, and have in addition a box containing 8 series resistors for outside-source telephone calling lamps.)

A separate talkback microphone is needed; this may be mounted as required on site.

Main Control Panel (*Fig.* 1.6.1)

Of the 16 units composing the main control panel, the following are identical with those fitted on desk SCD/8:

Apparatus control panel,
Reproduce/record remote-starting panel,
P.P.M. instrument panel,
Monitoring panel,
Cue programme panel,
Outside source telephone and P.F.L. panel.

The remaining units comprise:

Main fader panel,
Two outside source channel fader panels and two blank panels on a standard desk (although all necessary wiring is provided to allow four outside source panels to be fitted if required),
Incoming contribution channel fader panel,
Three microphone channel fader panels,
One gram fader panel.

Note that the microphone and gram channel fader panels on desk SCD/9 are the same as the narrator's channel fader panel on desk SCD/8.

Mounted directly on the main panel at the bottom left- and right-hand corners respectively are two *Studio Talkback* keys. Mounted immediately to the left of the right-hand *Studio Talkback* key is a *Clean Feed Talkback* key.

Main Fader Panel

This panel carries the main control fader, Type PB/11M/1. The fader is fitted with a white knob and has the usual black mask, arranged to uncover a 90-degree sector of a 265½-degree scale progressively as the fader is rotated to increase programme volume.

The PB/11M/1 is an unbalanced 600/600-ohm bridged-T attenuator having 32 studs with a loss ranging from zero on stud 31 to infinity on stud 0. The loss per stud between intermediate studs is:

Studs	1–4	4–8	8–11	11–31
Loss	5 dB	4 dB	3 dB	2 dB

An off-normal change-over contact operating between studs 0 and 1 is fitted. This operates in the loudspeaker cut-off circuit. (See Section 2.6.)

Outside Source Channel Fader Panels

These panels each carry a black-knobbed fader, Type PB/10M/1, fitted with a mask uncovering a 180-degree scale as the fader is moved to increase programme volume.

The PB/10M/1 is an unbalanced 600/600-ohm bridged-T attenuator having 22 studs with a loss ranging from zero on stud 21 to infinity on stud 0. The loss per stud between intermediate studs is:

Studs	1–2	2–4	4–6	6–10	10–21
Loss	8 dB	6 dB	4 dB	3 dB	2 dB

An off-normal change-over contact operating between studs 0 and 1 is fitted to the fader but not wired beyond the channel fader terminal block.

Incoming Contribution Channel Fader Panel

This panel carries a PB/10M/1 fader fitted with a red knob, a *Clean Feed* key provided with a locking handle and a red indicator-lamp which lights when the key is thrown. The *Clean Feed* key has two operated positions, one labelled *C.F. + T.T.B.* (clean feed plus transmission talkback) and the other merely *Clean Feed.*

Microphone and Gram Fader Panels

These identical panels are each fitted with a black-handled PB/10M/1 fader, together with a cue-light key and green indicator-lamp. The key and lamp are permanently associated with a given studio cue-light, which is placed conveniently with reference to the microphone or gram bank controlled from the particular panel.

Other Panels Used with Desk SCD/8

The remaining six types of panel are also used with desk SCD/8 as previously stated and have already been described in Section 1.2. For convenience the descriptions are repeated here.

Apparatus Control Panel (*Fig.* 1.2.7)

At the top of this panel are mounted a group of four mechanically interlocked apparatus-control push-buttons, labelled *Tone*, *Reh.*, *Trans.*, and *Off* respectively. Pushing any of these buttons except the one marked *Off* brings up the mains and battery power-supply relays and lights the blue *Rehearsal* warning lamps for the studio. Pushing the *Tone* button also applies 1-kc/s tone at −64 dB to the input of the main amplifier, from the output of which tone at zero level can then be sent to line, while pushing the *Reh.* button switches the talkback circuits to their rehearsal condition. The *Trans.* button, by contrast, has no additional functions, and the *Off* button merely serves as a mechanical release to the other three.

Also on the apparatus control panel are the control-room buzzer, the *Studio Red Light* key and three pull-switches; these switches, marked *Main Gain By-pass*. *Main Amp. C/O* and *Mon. Amp. By-pass*, are intended for use under fault conditions.

The *Main Gain By-pass* switch, when pulled out, replaces the main gain control potentiometer by a fixed-loss pad. The *Main Amp. C/O* switch causes the ' main ' and ' transmission talkback ' amplifiers to be interchanged.

The MNA/3 amplifier works at zero input and output levels, and the *Mon. Amp. By-Pass* switch simply removes this amplifier from the chain. Note, however, that when the amplifier is by-passed, there is no feed to the studio cubicle P.P.M., and control of level has therefore to be carried out elsewhere.

Reproduce/Record Remote-starting Panel

This is used to start a remotely located magnetic-tape machine, thus facilitating the reproduction of recorded material into the programme originating in the studio, or enabling the programme itself to be recorded.

The panel is provided with separate *Start* keys for reproducing and for recording. A white lamp above the appropriate key lights as an indication that a suitable magnetic-tape machine is tied to the panel circuits and is correctly set up for a remote start.

The remote starting of a *recording* machine from the panel also brings up the studio red light, which is arranged to come on about 2 seconds after power is applied to the machine. The intention is to ensure a wow-free start to the recording when circumstances make it desirable to use the red light as a starting cue for the artists in the studio.

P.P.M. Panel

This panel carries a P.P.M. instrument with preset variable resistance *Zero* adjustment. It is fed from an MNA/3 amplifier on the studio apparatus bay.

Monitor Panel (*Fig.* 1.2.5)

This has two groups of controls, one for the studio loudspeaker and the other for the cubicle loudspeaker. The controls for the studio loudspeaker comprise a programme-selector switch together with a loudspeaker cut-off switch. The controls for the cubicle loudspeaker consist of a programme-selector switch, a volume-setting switch, a loudspeaker dimming key and another key which allows the direct output of the studio to be switched rapidly to the cubicle loudspeaker when the programme-selector switch is set to a position other than the studio output.

Positions 1 to 7 on the programme-selector switches are used for ring-main feeds, position 8 normally gives the output of the studio, and position 9 is reserved as usual for feeding any special programme. Position 10 provides a monitoring feed from a recording circuit when one is engaged by the studio. Exceptionally, at Bush House, London, position 11 gives the studio output, leaving position 8 for use with an additional ring-main feed.

Outside Source Telephone and P.F.L. Panel (*Fig.* 1.2.8)

This panel provides prefade listening and control telephone facilities for use with programme sources located outside the studio. The panel is supplied equipped and wired to handle up to four outside sources, although normally only two outside source fader panels are installed.

The prefade keys, of the locking type, are mounted at the bottom of the panel. When one of the keys is pulled out, the desk headphones are transferred from the normal monitoring feed to the source that is being prefaded. If more than one key is out at a time, the first one to be moved takes priority.

The outside source telephone circuits are associated with the right-hand one of the two handsets. The telephone is routed via the E.M.X., but is not supervised by the E.M.X. operator unless his attention is specially called.

Each outside source circuit is provided with a white *Calling* lamp, an *Answer/Recall* lever-key and a *Ring* push-button. The *Answer/Recall* key

is locking in the down (*Answer*) position, but non-locking in the up (*Recall*) position. (The *Ring* push-button is also non-locking.) The *Answer* position of the key allows the studio to speak with the outside source, whereas the *Recall* position is used if it is necessary to call the attention of the E.M.X. operator.

An incoming call causes the telephone buzzer to start sounding and lights the white *Calling* lamp associated with the circuit. When the handset on the right-hand side of the desk is lifted and the *Answer* key is operated, the *Calling* lamp goes out and the buzzer stops sounding. Conversation can then proceed.

If the call is not answered by the studio within some 20 seconds of its inception, the buzzer is switched off, leaving the *Calling* lamp still alight. In these circumstances, the next time the source rings, the attention of the E.M.X. is called. This special circuit condition is cancelled as soon as the studio answers the source.

Control Room Telephone

The left-hand telephone is used for communication with the control room and is brought up to the E.M.X. where one is installed. At Bush House, London, the E.M.X. telephone is also the ' destination ' telephone, which is connected automatically to a continuity or control desk or a recording room, when this point selects the studio as a source.

Cue Programme Switching Panel

This panel carries four lever-keys used to switch cue programme to the control line connecting with an outside source during such time as the line is not being used for telephone communication. The cue programme is cut off automatically during telephone calls.

Relays and Relay Boxes

The main control panel baseplate carries relays MGB and TWT.

The low-level unit comprises relays ICM, ICT, MCO, TN and TTM.

Relay box RLB/47A houses relays LSO, TTO, OCT, OCM, TW, CDM, SLS, NLS, MNA, RH, PFA, PFB, PFC, PFD, TWL, LSA and DHP; of these, relay NLS is not used.

Relay box RLB/48C houses relays RC, LC, RD, LD, GC, GO, RO, RDB, RDA, LCF, RTC, AL, RDC and WP; of these, relays RC, LC, RD and LD are not used. The box also contains telephone transformers, a choke, capacitors and other components used with the telephones and red-light circuits.

Relay box RLB/48A, used at Bush House, is described on page 10.

Relay box RLB/49 is unequipped.

Relays boxes RLB/47A, RLB/48C (or 48A) and RLB/49 are arranged to jack into hinged mounting panels which can be swung forward giving access to the rear wiring.

Studio Apparatus Bay SAB/2

Construction and Assembly (*Fig.* 1.6.2)

This 19-in. bay is similar to bay SAB/1 described in Section 1.3, except that each amplifier-mounting panel carries only six amplifiers instead of 11 and that a small jackfield is also included.

The front of the bay only is equipped, the apparatus provided being as follows:

2 Amplifier-mounting Panels AP/1A,
1 Jackfield JF/111,
1 Mains Unit MU/51 (2 sections),
1 Supply Distribution Panel SDP/1,
1 Mains Distribution Panel MDP/5 (or MDP/4),
1 Mains Unit MU/51 (2 sections).

Amplifier-mounting panel AP/1A and mains unit MU/51 are described in Instruction S.3.

Fig. 1.6.2 shows the layout of an SAB/2 bay using a Type-12 bay framework, which is constructed from 5¼-in. bent-up channeling. Bays with serial numbers 101 to 110 inclusive are assembled on the older Type-9 framework measuring 3½ in. from front to back, and these bays also use an MDP/4 instead of an MDP/5.

Amplifier Panels

The upper of the two AP/1A panels is concerned with low-level and the lower with high-level circuits. The upper panel carries five AMC/5 amplifiers, and the lower panel four AMC/5 amplifiers and one MNA/3. Each panel is also equipped with a spare AMC/5 and a switch unit for bridging it across a defective amplifier. The wiring to the switch unit on the lower panel is so modified that it is not possible for the MNA/3 to be bridged by the spare AMC/5.

The circuit functions of the individual amplifiesr are marked on Fig. 1.6.2. Amplifier 7 is an additional reserve AMC/5. The input to amplifier 20 (the MNA/3) is wired via a break-jack at the bottom of the lower panel. To the right of the break-jack is a further jack used to supply zero-level test-tone for lining up the P.P.M. operated by the MNA/3.

Supply Distribution Panel SDP/1

Panel SDP/1 is fitted with six sockets behind a protecting front cover. Four of these are connected to the outputs of the four MU/51 sections and the remaining two are left unwired. Cables from the two AP/1A panels are plugged to two of the sockets on the SDP/1; the two remaining live sockets provide reserve supplies.

Mains Distribution Panels MDP/4 and MDP/5

Panel MDP/4 used with the Type-9 bay framework is fitted with four 3-pin 13-amp mains sockets. These sockets are plugged to the inputs of the four MU/51 sections.

Panel MDP/5 used with the Type-12 bay framework is fitted with six fuse links, two of which are left unwired.

Power Supply Cabinet PSC/3

This cabinet is in effect a PSC/2 (Section 1.4) less surplus cue-light relays. The cabinet comprises five compartments, which (from left to right) house:

1. 50-volt d.c. equipment,
2. Signal-lamp mains-supply relays,
3. Mains-voltage distribution board,
4. Mains-supply circuit-breakers,
5. Mains-supply control equipment.

Near the top of the left-hand compartment is an indicator-lamp which lights to show that the 50-volt supply is *on*. Close to the lamp is a double-pole switch, controlling the supply to a fuse-panel below. Also mounted near the top of the compartment is a fuse-alarm buzzer, connected via a resistor to the fuse-alarm bar. Behind a small screw-on cover-plate at the bottom of the compartment is the distribution-block through which the 50-volt supply is conveyed to the control desk.

The relay compartment contains the cue-light relays, together with relays for the studio red light and for the usual blue *Rehearsal* light and white *Telephone* lights; also mounted here is a mains-supply remote-control relay. Below the relays are their associated anti-click circuit components, and at the bottom of the compartment is a Grelco block for desk cue-light key connections.

The adjacent distribution-board compartment is used to terminate the mains-supply circuits for all equipment in the studio and cubicle and to house a spare (15-amp) circuit-breaker.

The next compartment houses six miniature circuit-breakers. Of these, three with instantaneous

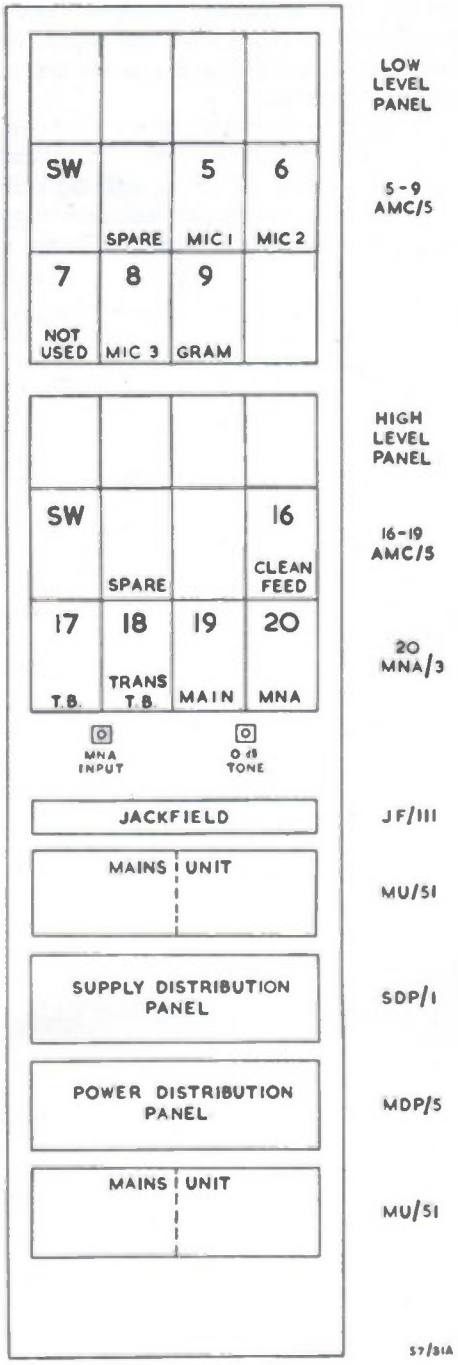


Fig. 1.6.2. Studio Apparatus Bay SAB/2: Layout Using Type-12 Bay Framework

action control the lighting supplies via wall-switches, and three with thermally delayed action control the technical supplies; one technical circuit-breaker is used for cue-lamps, one for the studio apparatus bay and one for the gram desks and loudspeakers.

The final compartment on the right, which carries a phase disk on the front panel, contains a master mains switch for the studio lighting and a *Direct/Remote* mains switch for technical supplies. The *Direct/Remote* switch, when thrown to *Direct*, connects the incoming mains to the technical-supplies circuit-breakers directly; when thrown to *Remote*, the switch connects the mains to the circuit-breakers via the mains-supply remote-control relay, which is operated from the *Tone*, *Transmission*, *Rehearsal* and *Off* push-buttons on the control desk.

The circuit details of the cabinet are described in Section 2.1. The cue-light circuits of the Mark I equipment are described in Section 2.6 and are illustrated in Fig. 9.

SECTION 1.7

MARK I EQUIPMENT: THE PROGRAMME CHAIN

General

The programme chain of the Mark I equipment is shown schematically in Fig. 7. In this drawing, for reasons of clarity and size, no wiring information appears. A schematic diagram drawn to a larger size and bearing all necessary wiring information for maintenance purposes should be available in the station drawing files. Except where a special diagram is provided by Planning and Installation Department for the station, Drawing No. PID 4967.9.1E should be supplied.

Input Section

Provision is made for three normal microphone channels, together with an emergency microphone wired straight through to the control room in the usual manner; only one channel is normally provided for grams. The microphone and gram channels each comprise an AMC/5 amplifier, followed by a microphone correction unit or an attenuator of suitable value if required, and a channel fader feeding into a common (high level) star mixer with a capacity of 5 channels. To preserve correct impedance conditions, the unused input of the star mixer is terminated with 600 ohms.

Also provided are two outside source channels, comprising incoming programme outside source lines No. 1 and 2 wired respectively to outside source fader channels No. 2 and 3. Faders No. 1 and 4 are not provided, but two blank panels carry terminal blocks at their rear to which all the necessary cables for additional faders are wired. Since the inputs to the outside source channels are normally at zero level, a loss-pad is required in each of them instead of an amplifier, and a repeating-coil is interposed between the balanced input circuit and the unbalanced channel fader.

The two outside source channel faders and the high level star mixer feed into a second (low level) star mixer, also with a capacity of 5 channels, and with its two unused inputs terminated in 600 ohms. At Bush House a loss-pad is inserted between the two star mixers. (See Fig. 7, Note 4.)

Every microphone and gram channel has a *Listen* test-jack prior to the amplifier, while every outside source channel has a *Listen* jack prior to its loss-pad. Prefade listening on the outside source channels is also provided via the desk headphone circuit, and in addition the incoming programme line for outside source No. 1 is tapped off to the studio headphone circuit and via relay TWL to channel 7, which is provided for handling the incoming contribution to a two-way programme.

Main Gain Control and Output Sections

The main gain control can be by-passed as in the Mark II equipment via the contacts of a relay and a fixed-loss pad. From the main gain control, the programme is routed to a hybrid coil, at which the signal path divides. One branch joins with the incoming contribution channel and thence passes to the main (No. 19) amplifier, while the other goes to supply a clean feed circuit.

Tone at −64 dB for line-up purposes is supplied when necessary via the TN relay directly to the input of amplifier No. 19. The output of this amplifier, which is obtained a zero level from a source impedance of 600 ohms, is fed direct to the studio output line, also terminated at either the local or the remote end by 600 ohms.

Monitoring (Fig. 7)

In parallel with the studio output line from the main amplifier (No. 19) is a connection to the monitoring circuits shown in Fig. 7. Amplifier 19 output is taken to the input of an MNA/3 (Instruction S.3) which provides visual and aural monitoring feeds. To facilitate lining-up operations the MNA/3 input is brought up on a break-jack at the bottom of the lower panel AP/1A on the SAB/2 bay, a further jack to the right providing a feed of 1-kc/s tone at the appropriate test level of 0 dB. The audio gain of the MNA/3 amplifier is 0 dB, and in the event of a fault it can therefore be by-passed via the contacts of the MNA relay, although with the loss of the visual monitoring feed. The audio output of the MNA/3 is taken to *Programme Select* switches for the cubicle and studio.

The *Cubicle Programme Select* switch feeds the cubicle loudspeaker, via the contacts of cut-off and dim relays operated respectively by either *Studio Talkback* key and by the *Cubicle Loud-*

speaker Dim key or, except at Bush House, by the *Clean Feed Talkback* key. Mounted on the monitor panel are two further controls included in the cubicle loudspeaker circuit. Out of these is a key used to by-pass the *Cubicle Programme Select* switch and listen directly on the MNA/3 output; the other is a volume control.

The *Studio Programme Select* switch feeds the studio loudspeaker, the studio and control-desk headphone circuits, and a cue-programme amplifier (in the control room) which provides the feed for the outside source control lines on operation of the appropriate key mounted on the cue programme switching panel described in Section 1.6. The connection to all these circuits is made via the TTO relay, which under appropriate conditions changes over the listening circuits from the monitoring chain to the talkback chain.

Clean Feed Arrangements (Fig. 7)

The programme chain includes special arrangements for providing a clean feed of the local studio output for use in connection with two-way programmes or otherwise. Corresponding arrangements are included to allow the studio to listen to a selected incoming contribution alone and to permit talkback down the clean feed line. Suitable routing is provided on the operation of the *Clean Feed* key. When this key is operated (either to *Clean Feed* or to *C.F. + T.T.B.*) relays TWL and TW operate, the latter restoring to normal, however, if a *Studio Talkback* key is thrown.

The selected incoming contribution is fed from the control room to the studio on outside source line 1, and with relay TWL operated the signal appears on channel 7, the output of which joins the main chain on the output side of the hybrid coil, beyond the main gain control.

The available signal level is some 5 or 6 dB higher than the average level of locally originated programme, and some measure of control can therefore be exercised at the channel fader. The connection of channel 7 to one output winding of the hybrid coil permits a clean feed of the local studio output to be supplied to the distant location from another winding; this feed is routed to the control room via relay TWT, amplifier No. 16 and relay TWL.

For local listening, the incoming contribution is tapped off across outside source line 1, and applied via the operated relay TW to the studio headphone circuit.

Clean Feed Talkback is discussed on page 31.

Talkback Arrangements (Fig. 7)

General

Different talkback arrangements are used under (a) rehearsal and (b) transmission conditions.

(a) Under the rehearsal condition, the output of the talkback microphone provided at the control desk is routed via the talkback amplifier (No. 17), the MCO relay and the main amplifier (No. 19) to the MNA amplifier (No. 20) and the studio loudspeaker. To prevent howlback, the cubicle loudspeaker is cut off so long as the talkback key is depressed.

(b) Under the transmission condition, the talkback microphone output is routed via the talkback amplifier (No. 17), the transmission talkback amplifier (No. 18) and the TTO and TW relays to the studio headphones. The cubicle loudspeaker is dimmed and carries the programme output of the main amplifier (No. 19), but the studio loudspeaker is cut off by means of fader off-normal contacts if any microphone is live.

Both under rehearsal and under transmission conditions, if the *Clean Feed* key is thrown, relay TW (Fig. 7) operates and the studio headphones are put onto the incoming contribution line for outside source No. 1. Relay TW releases when either *Studio Talkback* key is thrown, making talkback to the studio available on headphones.

Rehearsal Talkback to Studio

When either *Studio Talkback* key is thrown, relays LSO, MCO and SLS operate. Relay NLS also operates, although this relay is not in fact used, and for that reason it is not shown in Figs. 7 and 8.

LSO cuts off the cubicle loudspeaker, while MCO connects the output of amplifier No. 17 to the input of amplifier No. 19, thus completing the talkback circuit as far as the MNA/3 amplifier. Provided that the studio *Programme Select* switch is set to the studio monitoring output point, the MNA/3 output passes via TTO-1/2 to the studio headphones and to control lines taking cue programme. Relay SLS connects the studio loudspeaker.

Transmission Talkback to Studio

When either *Studio Talkback* key is thrown, relays CDM, TTM and TTO operate. CDM dims the cubicle loudspeaker, and TTM connects

amplifiers No. 17 and 18 together, while TTO connects amplifier No. 18 to the studio headphones and to control lines taking cue programme. Transmission talkback is fed in addition to the studio loudspeaker if all microphones are faded out at the main or channel faders.

Clean Feed Talkback

The action of the ***Clean Feed Talkback*** key depends upon the setting of the ***Clean Feed*** key. If the ***Clean Feed*** key is not operated, the ***Clean Feed Talkback*** key is ineffective, except for operating the CDM relay and thus dimming the cubicle loudspeaker. With the ***Clean Feed*** key in the ***Clean Feed*** position, the ***Clean Feed Talkback*** key merely operates relay CDM if the studio is switched to transmission, but operates relay TWT as well if the studio is switched to rehearsal; the operation of relay CDM dims the cubicle loudspeaker, while that of TWT connects the output of amplifier No. 17 to the input of amplifier No. 16 and thence via the contacts of TWL to the clean feed line. With the ***Clean Feed*** key in the *C.F. + T.T.B.* position, the ***Clean Feed Talkback*** key operates both when the studio is switched to rehearsal and when it is switched to transmission. The ***Clean Feed Talkback*** key may if necessary be operated at the same time as one of the ***Studio Talkback*** keys.

NOTE:—Desks Type SCD/9 with serial numbers between 101 and 111 inclusive (all at Bush House) were manufactured with no *C.F. + T.T.B.* position on the ***Clean Feed*** key and no ***Clean Feed Talkback*** key. Two ***Talkback*** keys are provided each of which switches talkback simultaneously to the studio and to the clean feed line on rehearsal, and to the studio only (subject to the normal precautions against howlback) on transmission.

Main Amplifier Emergency Change-over

When the *Main Amplifier Change-over* key on the equipment control panel is pulled out, relays ICM, ICT, OCM and OCT operate. The relative circuit positions occupied by the main amplifier (No. 19) and the transmission talkback amplifier (No. 18) are thereby interchanged. Thus, if amplifier 19 should develop a fault on transmission, amplifier 18 can immediately be substituted; as soon as time permits, the faulty amplifier can then be bridged, withdrawn and replaced on the AP/1A.

PART II: CIRCUITS

SECTION 2.1

POWER SUPPLY, EQUIPMENT SWITCHING AND EMERGENCY CIRCUITS

Power Supply Distribution

Cabinets PSC/2, PSC/2A, PSC/3

In the Type-B Studio Equipment the power supply is distributed from a wall-mounted cabinet coded as follows:

Mark I Equipment: Cabinet PSC/3
Mark II Equipment: Cabinet PSC/2
Mark III Equipment: Cabinet PSC/2A

These cabinets differ only in the number of signal-lamp relays fitted, which is least in the PSC/3 and greatest in the PSC/2A. The feeds taken from the cabinets also differ in that the fuse-way protecting the 50-volt d.c. supply to the desk supplies no other equipment from the PSC/3, one further wall-mounting cabinet from the PSC/2 and two further cabinets from the PSC/2A.

Mains Supply (*Fig.* 2.1.1)

The distribution of 230-volt a.c. supplies from cabinet PSC/2 to the Mark II equipment is shown schematically in Fig. 2.1.1. It will be noticed that the studio-lighting supply busbars are fed from the mains via a double-pole two-position isolator switch, and that the apparatus-supply busbars are fed via a double-pole switch having three positions, marked *Remote*, *Direct* and *Off*. When the switch is in the *Remote* position, the supply to the busbars is controlled by mains relay MNS, which is operated from the *Tone*, *Transmission* and *Rehearsal* buttons on the equipment control panel as shown in Fig. 2.1.3. The *Direct* and *Off* positions of the switch are self-explanatory.

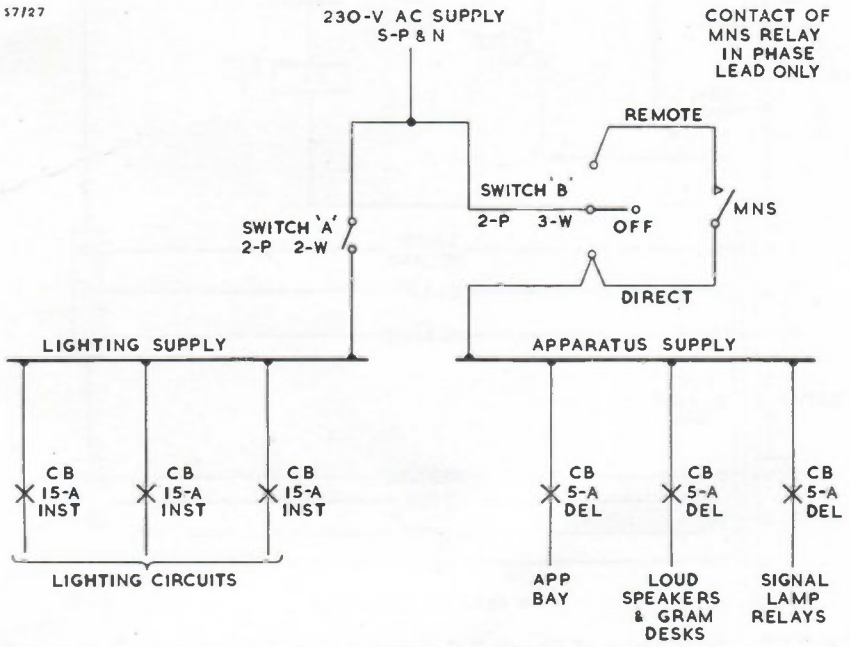


Fig. 2.1.1. Distribution of 230-volt A.C. Supplies from Power Supply Cabinet PSC/2

The apparatus-supply circuit-breakers are fitted

with thermal delays which prevent tripping on switching surges; the signal-lamp relay circuit-breaker is included in this arrangement merely to simplify the spares position.

Battery Supply (*Fig.* 2.1.2)

The distribution of 50-volt d.c. supplies from cabinet PSC/2 to the Mark II equipment is shown in Fig. 2.1.2. The positive side of the battery is earthed, and the negative side is taken to a fuse busbar split into two sections connected via the the RLB/47A relay box, are fed from the lower section controlled by BAT-1.

Except where the 50-volt power supply is directly concerned, contact BAT-1 will generally be omitted from circuit drawings for the sake of simplicity.

Equipment Switching Circuit (Fig. 2.1.3)

The equipment switching circuit controlled by the *Tone*, *Rehearsal*, *Transmission* and *Off* buttons is shown in Fig. 2.1.3. Each button is mechanically

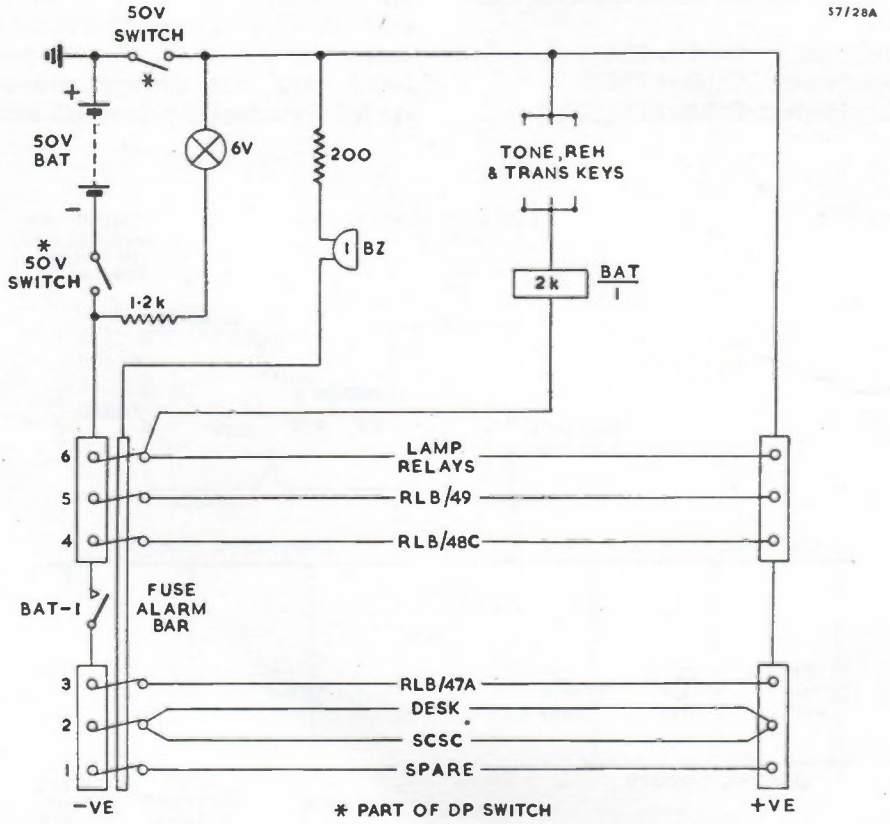


Fig. 2.1.2. Distribution of 50-volt D.C. Supplies from Power Supply Cabinet PSC/2

contact of relay BAT. The winding of this relay is fed from the upper section of the busbar and, like that of the MNS relay, is energised via the *Tone*, *Transmission* and *Rehearsal* buttons on the equipment control panel as shown in Fig. 2.1.3. Further feeds from the upper busbar section are taken to relay boxes RLB/48C and RLB/49, as well as to the lamp relays housed in the PSC/2 itself. The source and cue selection cabinet and the remaining desk circuits, including the low-level relay unit and interlinked with the other three in such a way that when any one of them is pressed it is held in and automatically releases the previously operated button.

The *Tone*, *Rehearsal* and *Transmission* buttons carry contacts which operate relays MNS (Fig. 2.1.1) BAT (Fig. 2.1.2) and BL, this last being the studio blue light relay. The *Tone* button in addition operates relay TN, so applying tone to the input of the main amplifier as shown in Figs. 1 and 7. The

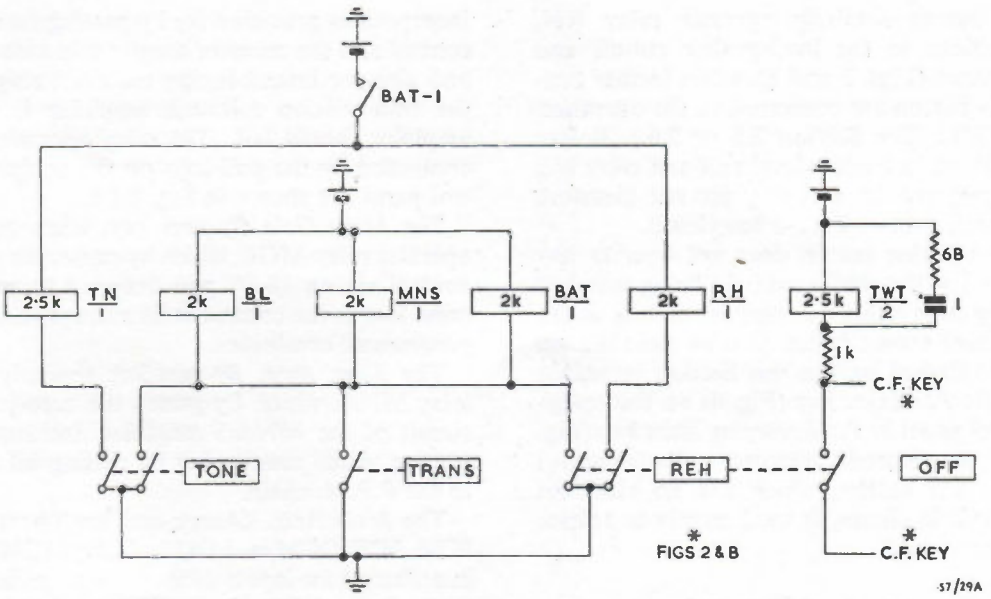


Fig. 2.1.3. Equipment Switching Circuit

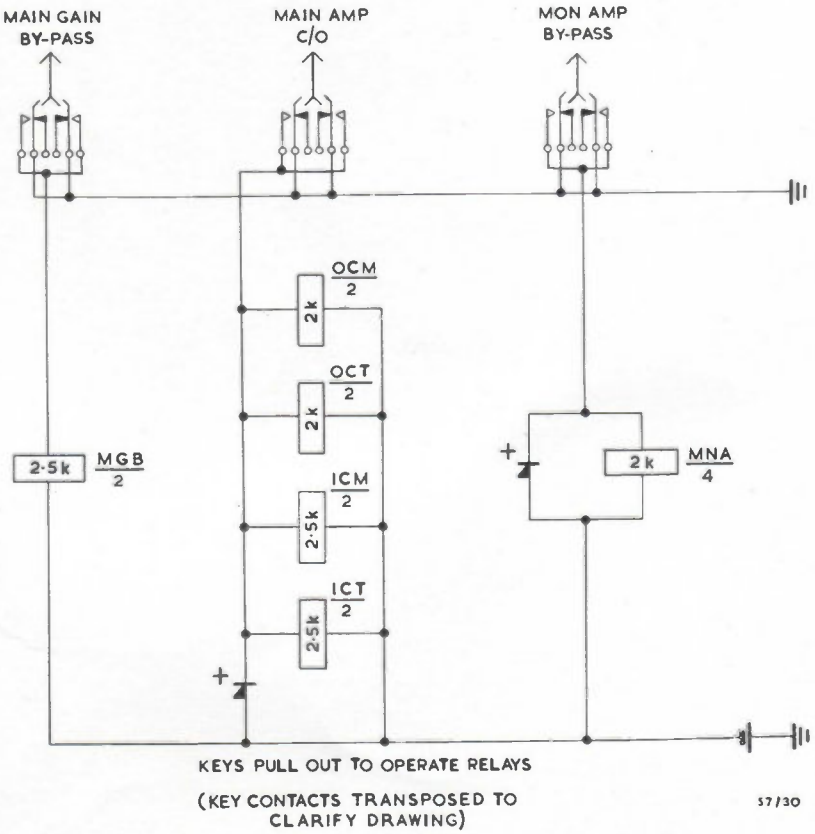


Fig. 2.1.4. Change-over and By-pass Switching Circuits

Rehearsal button similarly operates relay RH, which functions in the loudspeaker cut-off and talkback circuit (Figs. 2 and 8), while further contacts of this button are concerned in the operation of relay TWT. (See Section 2.5 or 2.6.) Relays TN and RH are in the low-level unit and relay box RLB/47A respectively, and they are not therefore energised until contact BAT-1 has closed.

The *Transmission* button does not operate any additional relay, the studio red light being switched on normally from either a continuity cubicle or the central control room; it can also be switched on locally as explained later in this Section by means of the *Studio Red Light* key (Fig. 4) on the equipment control panel or the *Recording Start* key (Fig. 2.4.1) on the reproduce/record remote-control panel. The *Off* button, which has no electrical contacts wired in circuit, is used merely to release the other three.

Emergency Change-over and By-pass Switching Circuits (Fig. 1 or 7)

As previously explained the programme chain incorporates provision for by-passing the main gain control and the monitor amplifier in case of failure and also for interchanging the main amplifier and the transmission talkback amplifier if the main amplifier should fail. The relay operating circuits controlled by the pull-keys on the equipment control panel are shown in Fig. 2.1.4.

The Main Gain By-pass key, when pulled out, operates relay MGB, which by-passes the main gain control via an 18-dB pad designed to present the same loss as the control at its average setting under programme conditions.

The *Mon. Amp. By-pass* key similarly operates relay MNA, which by-passes the zero-gain audio circuit of the MNA/3 amplifier, incidentally preventing visual monitoring by cutting off the input to the P.P.M. chain.

The *Main Amp. Change-over* key operates relays ICM, ICT, OCM and OCT. Relays ICM and ICT interchange the inputs of the main amplifier and the transmission talkback amplifier, while relays OCM and OCT interchange the outputs of these amplifiers.

SECTION 2.2

TELEPHONE AND OUTSIDE SOURCE CIRCUITS

Control Room Telephone (Fig. 5)

General

The control room telephone handset is carried at the left-hand end of the studio cubicle control desk. This handset is labelled *Tele. No.* 1 in Fig. 5.

Incoming Calls

Upon the receipt of ringing current, relay AL operates via RDB-1/2.

AL-1 operates relay WP.

AL-2 operates the telephone buzzer.

WP-1 de-operates relay LCF.

WP-2 operates relay CWH. If relay RED is not operated, WP-2 also operates relay SWH.

WP-3 locks in relay WP.

In P.I.D. drawings of Bush House equipment, contact numbers WP-1, WP-2 and WP-3 are interchanged as indicated by the ringed designations in Fig. 5.

LCF-1/2 prepare a circuit from the handset to the control room line as far as RDB-1/2.

LCF-3 is ineffective.

CWH-1 switches on the cubicle white 230-volt telephone indicator-lamp.

SWH-1 switches on the studio white 230-volt telephone indicator-lamp unless the studio red lamp is on.

At the termination of the incoming pulse of ringing current, relay AL releases.

AL-2 opening cuts off the cubicle telephone buzzer.

AL-1 also opens, but as relay WP is self-holding via WP-3, this relay and consequently relays LCF, CWH and SWH remain operated.

When the handset is lifted, the rest-switch contact closes, operating relay RDB.

RDB-1/2 complete the circuit from the handset to the control room line.

RDB-3 energises the transmitter via retard coil RDC.

RDB-4 releases relay WP, which falls out, followed by the lamp relays CWH and SWH.

RDB-5 holds off relay LCF in spite of the making of WP-1.

The replacement of the handset on its rest causes the circuit to clear down.

Outgoing Calls

Lifting the handset closes the rest-switch and operates RDB as before.

RDB-1/2 send a pulse of 17-c/s ringing current to line. The duration of this pulse, of the order of 300 milliseconds, is controlled by the de-operating delay of relay LCF. (See below.)

RDB-3 energises the transmitter.

RDB-4 disables the self-holding circuit of relay WP, although this is not of any importance in the switching sequence under consideration.

RDB-5 releases relay LCF.

LCF-1/2 cut off the ringing current and connect the handset to the control room line.

LCF-3 short-circuits the ringing current supply for a very short period while relay LCF is operating. This prevents clicks from being induced into the programme circuits due to the breaking of the 17-c/s ringing current.

As soon as the handset is restored to its rest, the circuit clears down as previously.

Telephone No. 1 *Recall Key* (*Bush House*)

At Bush House, the control room (or E.M.X.) telephone labelled *Tele. No.* 1 in Fig. 5 is used as a 'destination' telephone, and is thus connected automatically to a local continuity or control desk or recording room, when this point selects the studio as a source. (See Instruction BU. 1.) *Tele. No.* 1 is similarly used when the destination is an external point, e.g., a recording room at Broadcasting House. In these circumstances the telephone and programme circuits are set up by the local and external control rooms, but there is no provision for the external recording room to recall the E.M.X. at Bush House, and a *Tele.* 1 *Recall* key is therefore required in Bush House studios to enable the studio itself to recall the E.M.X.

Operation of the key brings up relay SR in series with an already operated relay (LC).

SR-1 holds in relay SR.

SR-2 operates relay (L).

(L)-2 lights the E.M.X. *Call* lamp for the studio.

When the E.M.X. answers, relay SR is earthed via a level of the E.M.X. *Answer* selector and falls out, followed by relay (L).

Note that only part of the (LC) and (L) relay circuits is shown in Fig. 5. Further details will be found in station drawings of the E.M.X.

Outside Source Telephone (Figs. 5, 6, 11)

General

The outside source telephone is used in conjunction with the outside source and cue programme panels described in Section 1.2. The telephone handset itself is carried at the right-hand end of the desk. In the circuit diagrams, Figs 5, 6 and 11, this handset is referred to as *Tele. No.* 2.

Relay Panels

Each standard installation requires one relay panel, Type PA17/9, for the first two outside-source telephone circuits provided, together with one further similar relay panel for each additional two circuits. The panels are normally mounted in the control room. The equipment carried is indicated in a footnote to Fig. 6.

At Bush House, London, two earlier-type panels, the RLP/33 and RLP/34 (Fig. 11), are used instead of the standard panel PA17/9. In place of two of the relays, coded AX and AY respectively, the non-standard panels have a single four-in-one assembly carrying relays coded AW, AX, AY and AZ. The AX relay of the four-in-one assembly has only one contact group instead of two; the AW and AZ relays are additional; the AY relay is differently wired. The use of the four-in-one relay produces certain differences in circuit operation, which are considered under subsequent headings as they arise. However, the only functional difference between the standard and non-standard panels is that on the PA17s a ring in from an outside source cuts the feed of cue programme to the line immediately, whereas on the RLPs cue programme is cut only when the cubicle answers or the E.M.X. breaks in.

A further difference in the Bush House circuit results from the use of a cubicle pilot relay P. This lights the 230-volt white indicator-lamps which elsewhere are not used with *Tele. No.* 2.

Establishment of a Through Circuit

The telephone circuit between the studio cubicle and the outside source (together with certain indication and recall facilities to be described) is set up by the control room staff, either via specially allocated levels of source and route selection equipment, as illustrated in Fig. 6, or via a jack-field. The rest of the system is the same whichever method is used.

At this stage the E.M.X. tie circuit selectors, also indicated in Fig. 6, or their equivalent cord circuits, are not engaged.

The two selector levels (5 and 6) at the top of Fig. 6 carry the control line. The third level shown is used to bring up the (LC) relay for the outside source in the E.M.X. and the AX relay for the studio. The fourth level shown is used to call in the E.M.X. operator.

As soon as the circuit is established, the (LC) and AX relays operate.

(LC)-1 disconnects the E.M.X. *Calling* lamp relay (L) from across the outside source control line.

(LC)-2 disables the self-holding circuit of the (L) relay, and lights the *Engaged* lamp for the outside source on the E.M.X. board.

AX-1 removes an earth from the winding of relay AY.

AX-2 prepares a circuit for the *Cue Programme* key to operate relay CP via L-1, LC-3 and AY-2.

On Bush House equipments (Fig. 11) where contact AX-2 is not fitted, AX-1 both removes the earth from AY and prepares the circuit for CP.

Incoming Calls

When an outside source rings in, the line circuit L relay (shown near the top centre of Fig. 6) operates via RG-1/3 and LC-1/2.

L-1 (a) locks in relay L, releases relay CP, thus cutting the cue programme, if any, and energises the thermal delay relay TH, which begins to heat up, preparatory to operating.

(b) operates the cubicle *Calling* lamp on the outside-source telephone panel on the SCD/8 or 9.

L-2 sounds the cubicle buzzer.

At Bush House (Fig. 11) relay AW comes into play:—L-1 locks in relay L, L-2 operating relay AW. AW-1 then operates relay P and AW-2 energises TH, the thermal delay relay.

Relay P at Bush House operates as follows:

P-1 operates the cubicle white lamp relay CWH, and also the studio white lamp relay SWH if the studio red lamp relay RED is not operated. Relays CWH and SWH switch on the 230-volt white lamps, which are used to indicate a call on either the outside source or the control room telephone. (See Fig. 5.)

P-2 operates the cubicle telephone buzzer.

P-3 short-circuits part of P relay winding, so allowing a series *Calling* lamp, mounted on the

outside source control-panel on the desk, to glow as soon as the relay has operated.

The 230-volt white lamps (at Bush House) and the *Calling* lamp (which indicates which outside source has rung in) remain alight until the call is answered in the studio cubicle. The buzzer also continues to sound, but see the operation of TT-2 below.

To answer the call, the cubicle operator lifts his handset and throws his *Answer/Recall* key to ANSWER. Lifting the handset energises the transmitter and operates relay RDA.

RDA-1 closes and operates a studio outside source LC relay via the *Answer/Recall* key.

LC-1/2 connect the handset through to the line. (At Bush House, these contacts also cut off any feed of cue programme.)

LC-3 disables the self-holding circuit of relay L, which falls out. (At Bush House, relay L first releases relay AW, which in turn releases relay P.) The *Calling* lamp and buzzer de-operate. The not yet operated relay TH is de-energised.

If the cubicle operator does not answer the call, relay TH continues to heat up, and operates after some seconds delay.

TH-1 de-energises relay TH and operates the E.M.X. pilot relay (P) on the same mounting.

(P)-1 holds in relay (P).

(P)-2 prepares a circuit for relay TT.

TH-1 operates relay TT after a short interval, required for relay TH to cool down and restore to normal. (Taking into account both the operate and the release delays of the TH relay, the total time between the operation of relay L (AW at Bush House) and that of relay TT should normally be of the order of 20 seconds.)

TT-1 de-energises relay AX, and also the E.M.X. (LC) relay.

TT-2 cuts off the cubicle telephone buzzer.

AX-1 earths relay AY so that it cannot be operated by throwing the *Answer/Recall* key to RECALL.

AX-2 disables relay CP.

At Bush House, relay AX has only one contact; also relay AZ is fitted. Thus, TT-1 now operates relay AZ, although TT-2 still cancels the buzzer. AZ-1 de-energises relay AX and the E.M.X. (LC) relay. AX-1 earths relay AY and also releases relay CP, thus cutting off cue programme.

(LC)-1 prepares a circuit for relay (L) to operate via a rectifier the next time the source rings in.

(LC)-2 prepares the self-holding circuit of relay (L), and extinguishes the *Engaged* lamp.

When the source rings in again, relay (L) is operated by rectified ringing current.

(L)-1 holds in relay (L).

(L)-2 lights the *Calling* indicator-lamp for the source on the E.M.X. board.

When the E.M.X. answers, relay (LC) is operated from an earth applied via a level of the E.M.X. tie circuit selector as shown.

(LC)-1 disables one winding of relay (L).

(LC)-2 releases relay (L) and lights the *Engaged* lamp.

(L)-1 opens in the already broken loop of relay (L).

(L)-2 cuts off the *Calling* lamp.

When the E.M.X. has finished with the call, the operator releases the tie circuit selector, which homes and removes the earth from relay (LC). This relay consequently de-operates.

(LC)-1 re-connects relay (L) across the outside source control line.

(LC)-2 cuts off the *Engaged* lamp, and prepares the self-holding circuit of relay (L) for use again.

Meanwhile, the outside source *Calling* indicator-lamp in the cubicle (and at Bush House the 230-volt white lamps) remain alight. When the cubicle operator finally lifts his handset and throws his *Answer/Recall* key to ANSWER, relay RDA makes via the rest-switch.

RDA-1 operates the appropriate studio outside source LC relay via the *Answer* key contacts.

LC-1/2 connect the handset to the line.

LC-3 releases the corresponding L relay.

L-1 (a) disables the self-holding circuit of relay L, and prepares a holding circuit for relay CP.

(b) cuts off the cubicle *Calling* lamp and releases relay TT and the E.M.X. pilot relay (P).

L-2 cancels the cubicle buzzer.

At Bush House, L-1 disables relay L as before, but L-2 now releases relay AW. AW-1 then cuts off the *Calling* lamp and releases relay P, while AW-2 releases relays TT and (P).

Relay P at Bush House de-operates as follows:

P-1 releases relays CWH and SWH, so cutting off the cubicle and studio 230-volt white lamps.

P-2 opens in the cubicle buzzer circuit in series with contact TT-2.

P-3 removes the short-circuit from the 1·5-kilohm winding of relay P.

(P)-1 clears down the self-holding circuit of relay (P).

(P)-2 prepares the energising circuit of relay TH for use on a later occasion.
TT-1 operates relays AX and (LC).
TT-2 prepares the cubicle buzzer circuit to operate if the source rings in again.
AX-1 removes the earth from relay AY.
AX-2 prepares the circuit of relay CP.

At Bush House, TT-1 releases relay AZ, while TT-2 prepares the cubicle buzzer circuit as before. AZ-1 operates relay (LC). AX-1 both removes the earth from relay AY and prepares the circuit of relay CP.

(LC)-1 disconnects relay (L) from the outside source line.
(LC)-2 disables the self-holding circuit of relay (L), and lights the *Engaged* lamp again.

The studio cubicle now calls the attention of the outside source by ringing out as described under the next sub-heading.

Outgoing Calls

Lifting the handset (Fig. 5) energises the transmitter and operates relay RDA, whose contact RDA-1 prepares a circuit for the *Answer/Recall* and *Ring* keys. Throwing the *Answer/Recall* key for a given outside line to ANSWER operates relay LC in the control room.

LC-1/2 cut off the cue programme feed, if any, and connect the handset through to the outside source control line.
LC-3 disables the self-holding circuit of relay L, although this is of no particular significance in the present application.

Depressing the *Ring* key for the line operates an RG relay in the control room. (Note, however, that the *Ring* key is ineffective unless the *Answer/Recall* key is in the *Answer* position.)

RG-1/3 send 17-c/s ringing tone down the line.
RG-2 short-circuits one winding of relay L, but without further effect until the *Ring* key is released.

On the release of the *Ring* key, relay RG clears down; RG-2 is late in de-operating so that the line discharging cannot operate relay L and thus simulate an incoming call. As soon as the distant subscriber answers the ring, conversation can proceed.

At the conclusion of the call, the restoration of the *Answer/Recall* key to normal clears down relay LC.

If the *Answer/Recall* key is raised to RECALL, relay AY operates.
AY-1 locks in relay AY.
AY-2 operates an (L) relay in the E.M.X. This (L) relay, which is shown in the lower left-hand part of Fig. 6, operates a *Calling* lamp and buzzer in the E.M.X. via (L)-2. (The buzzer is not shown.)

When the *Answer/Recall* key is returned to ANSWER, the (L) relay continues to hold in via AY-2 until the E.M.X. operator answers the call. An earth from the E.M.X. tie circuit selector then causes relay AX to release.

AX-1 earths relay AY.
AX-2 releases relay CP, although the cue programme feed is already cut off by LC-1/2
AY-1 opens relay AY self-holding circuit.
AY-2 releases relay (L).
(L)-1 is ineffective.
(L)-2 releases the E.M.X. *Calling* lamp.

At Bush House, contact AX-1 both earths relay AY and releases relay CP.

Cue Programme

The arrangements for providing cue programme on outside source control lines when not in use for communication were mentioned in Part I. The cue programme feed from the studio (Fig. 1 or 7) is routed to a C/9 amplifier in the control room (Fig. 6) and thence via relay contacts CP-1/2, LC-1/2 and RG-1/3. Throwing the *Cue Programme* key for the control line operates relay CP provided the relay AX is operated. Contacts CP-1/2 switch the cue programme feed to the control line provided that relays LC and RG are not operated.

The 126-ohm output impedance of the C/9 amplifier is stepped down to 4 ohms by a transformer Type LL/59R. The components C1, R1 and C2, R2 provide a suitable splitting network.

At Bush House, the *Cue Programme* key has an alternative *Feedback* position, in which an FB relay is operated.

FB-1/2 connect the output of the cue programme amplifier via the source and route selectors to the source feedback line (brought out to point 10 of a studio HV/7).

Outside Source P.F.L. Circuit (Figs. 1, 5, 7)

Outside source prefade-listening circuits are shown in Figs. 1 and 7, the source P.F.L. relays appearing on the left of the diagrams and the desk headphone relay DHP appearing on the right. The operating circuits of these relays are shown in the upper right-hand portion of Fig. 5.

Pulling out any prefade key energises the appropriate source relay, e.g. PFA, in series with the headphone relay DHP.

PFA-1 short circuits the 1·5-kilohm winding of PFA, leaving the relay holding on its 50-ohm winding only. Owing to the voltage drop across R12 (Fig. 5), if any other P.F.L. key is pulled out, the current through the two windings of the consequently connected relay will be insufficient to operate it. Thus, prefaded sources cannot be accidentally mixed or brought up on transmission by careless operation of the keys.

PFA-2/3 connect the source to the desk headphone relay DHP.

DHP-1/2 switch the desk headphone jacks across the source prefade-listening circuit instead of across the output of the studio *Source Select* switch.

SECTION 2.3

STUDIO RED LIGHT AND CONTROL ROOM SIGNALLING CIRCUIT

General

Fig. 4 shows the studio red light and control room signalling circuit. Relays GC, GO, RO and RTC are in relay box RLB/48A, relay RED is in the power supply cabinet and the remaining relays shown are in a continuity cubicle or the control room.

The studio red light is controlled by relay RED, which can be operated by the ***Red Light*** key on the control desk, or by relay contacts RO-1 or RTC-1/2. RO-1 is concerned in the control room signalling circuit about to be described, while RTC-1/2 are concerned in the recording remote starting circuit to be described in Section 2.4.

Studio Buzz In

When the studio buzzes in, relay GO operates immediately. This relay has four groups of contacts, the action of which is as follows:

GO-1 removes a short-circuit from a 250-μF capacitor, which takes a finite time to charge up, so providing for the delayed operation of relay GC.

GO-2 (make-before-break contact)

(a) completes the circuit of relay RO via a 1·8-kilohm resistor which does not pass sufficient current to operate the relay.

(b) disconnects RO from the control room signalling line.

GO-3 operates the studio cubicle buzzer.

GO-4 (' late make ' or *y* contact) applies battery to the control room signalling line after GO-2 has disconnected RO from this line. The *y* operation of GO-4 avoids a surge in the winding of the RO relay and thus ensures that this relay does not operate.

The application of battery to the signalling line operates an ST relay in the control room, where the switching sequence is now as follows:

ST-1 operates the appropriate G relay.

ST-2 completes the circuit through the control room buzzer.

G-1 holds in relay G.

G-2 brings up the green lamp mounted above the signalling key for the particular studio.

The GC relay in the studio cubicle operates via the GO relay winding after some 500 milliseconds total delay measured from the initiation of the sequence.

GC-1 disconnects and short-circuits the 250-μF capacitor previously connected to GC.

GC-2 short-circuits GO. This relay releases, cutting off the studio cubicle buzzer and disconnecting battery from the control room signalling line. With the battery removed from the signalling line, relay ST de-operates and the control room buzzer is cancelled. Nothing further then occurs even if the studio (or cubicle) buzzer push is held operated.

When the appropriate studio signalling key in the control room is flicked to the raised non-locking position, relay G releases, cancelling the green light above the key.

Red Light Signal

When the studio signalling key is depressed to the locking position, battery is applied via 680 ohms from the control room end of the signalling lines. Relay RO now operates but relay ST in parallel does not operate on account of its higher circuit resistance, which reduces the current flow below the operating value.

RO-1 operates the studio red light relay RED.

RO-2 operates a repeater relay RP in the control room, whose contact RP-2 brings up a lamp on the central indicating panel.

Studio Buzz Out

When the studio buzzes out at the end of a programme, relays GO and GC operate as before. Relay RO, which remains energised for the duration of the programme, is held in via the make-before-break contact GO-2 and the 1·8-kilohm resistor, since the current required to hold the relay is appreciably less than that required to operate it. Relays RED and RP therefore, are also held, so that the studio red light remains on and continues to be repeated at the central indicating panel. The ST relay is operated as previously via GO-4.

When the studio signalling key in the control room is restored to normal, the red light circuit releases. If the key is then flicked to the raised position, relay G also releases, cancelling the green light.

SECTION 2.4
MISCELLANEOUS CIRCUITS

Reproduce/Record Remote-starting Circuits

The separate remote starting circuits employed for reproduction and for recording are indicated in Fig. 2.4.1. For both reproduction and recording a signal-lamp is provided which lights when the machine starting circuit is placed under the control of the studio. Also provided in each instance is a key for starting the machine by connecting battery to the line. The *Record* key further operates the studio red light relay (Fig. 4) via relay RTC, which is provided with an *RC* network giving a 2-seconds delay. The purpose of the delay is to ensure that the recording machine reaches a steady speed before the red light comes on, a necessary precaution since in certain circumstances this light may be used as a starting cue for the studio.

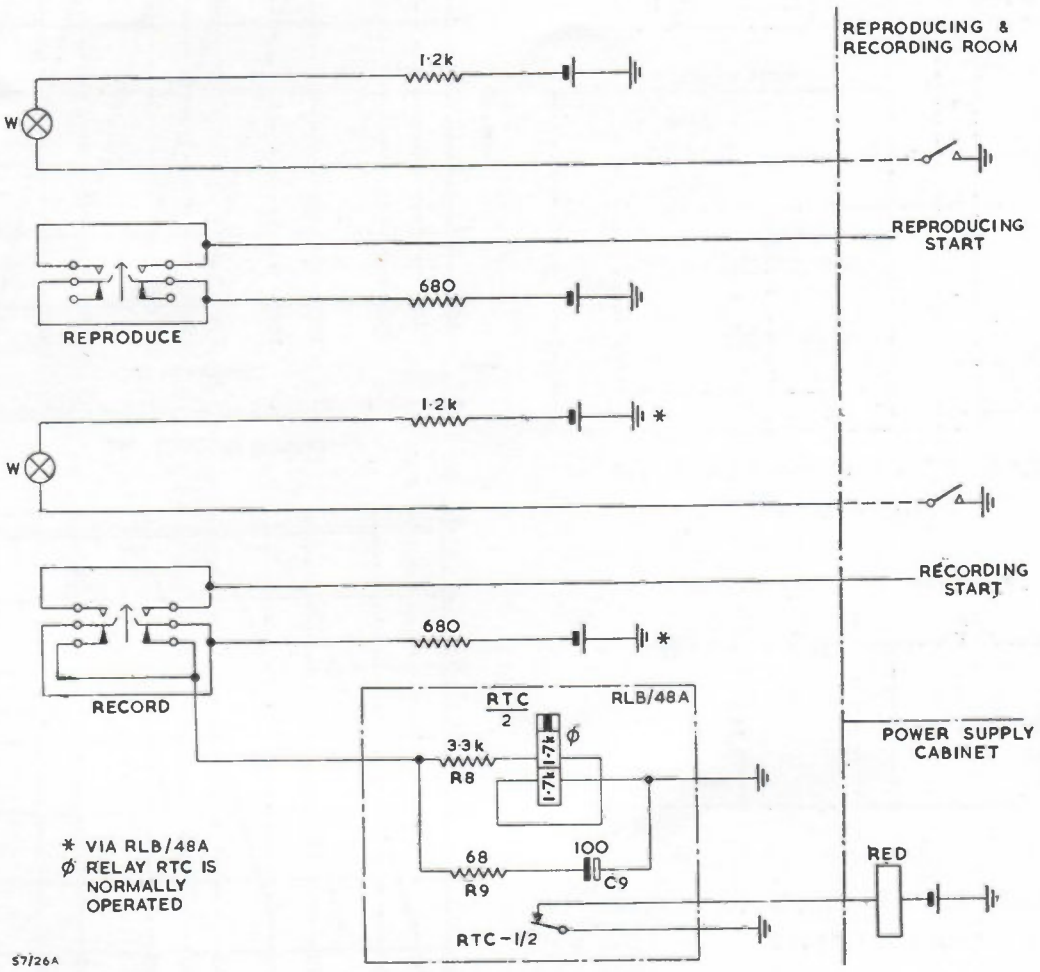
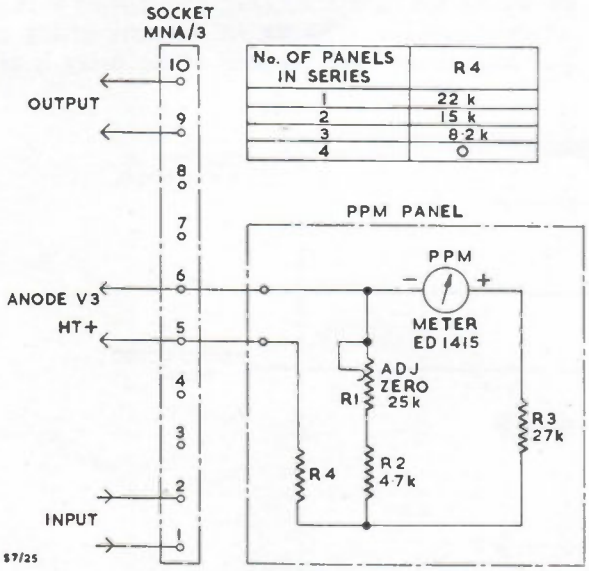


Fig. 2.4.1. Reproduce/Record Remote-starting Circuits

Drawing No. DSKB 3546

P.P.M. Instrument Panel Circuit (Fig. 2.4.2)

The circuit of the P.P.M. instrument panel is shown in Fig. 2.4.2. On the left are details of the plug-and-socket connection with the MNA/3 amplifier, full details of which are given in Instruction S.3. The value of the resistor R4 in the lead to the amplifier is normally 22 kilohms, but if further meter panels are connected in series, the value of R4 is altered as shown. The zero adjustment for the meter is provided by R1.



No. OF PANELS IN SERIES	R4
1	22 k
2	15 k
3	8·2 k
4	0

Fig. 2.4.2. P.P.M. Instrument Panel: Circuit
Drawing No. DA 2170

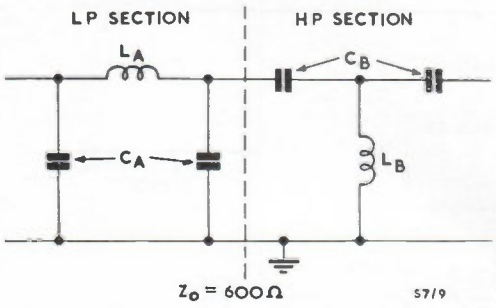


Fig. 2.4.3. Effects Unit EU/1A: Basic Circuit
Drawing No. DSKA 1168

Effects Unit EU/1A: Circuit

The basic circuit of the EU/1A is shown in Fig. 2.4.3. The unit comprises two filter sections, one a low-pass network and the other a high-pass network, each constructed in symmetrical unbalanced prototype form with a characteristic impedance of 600 ohms. The respective loss characteristics are shown in Figs. 2.4.4 and 2.4.5.

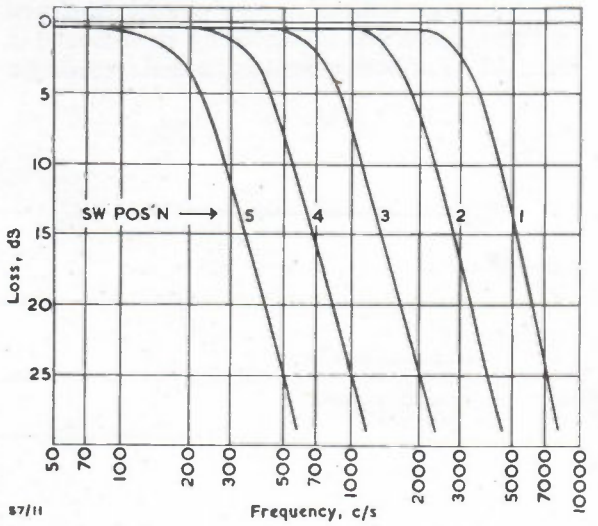


Fig. 2.4.4. EU/1A Low-pass Filter Characteristics
Drawing No. DSKA 1387

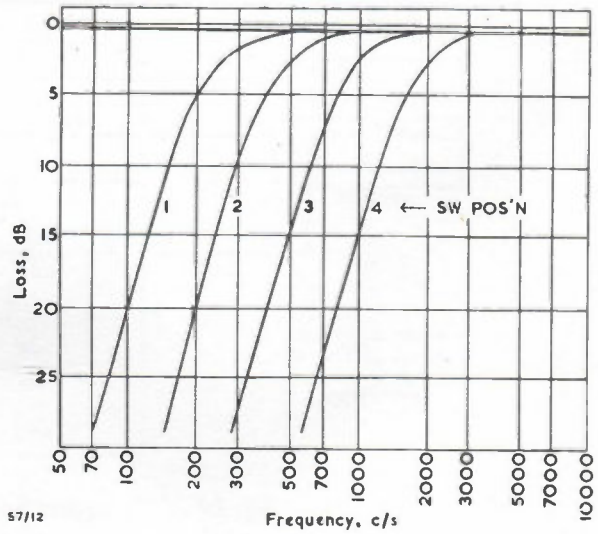


Fig. 2.4.5. EU/1A High-pass Filter Characteristics
Drawing No. DSKA 1388

Two identical EU/1A units are provided, both adjustable by means of switches on the effects control panel illustrated in Fig. 1.2.6. The circuit elements are arranged electrically as shown in

Fig. 2.4.6. The EU/1A units used in Mark III equipment are provided additionally with repeating-coils at the input and output terminations, because in this equipment the units are employed in balanced microphone circuits.

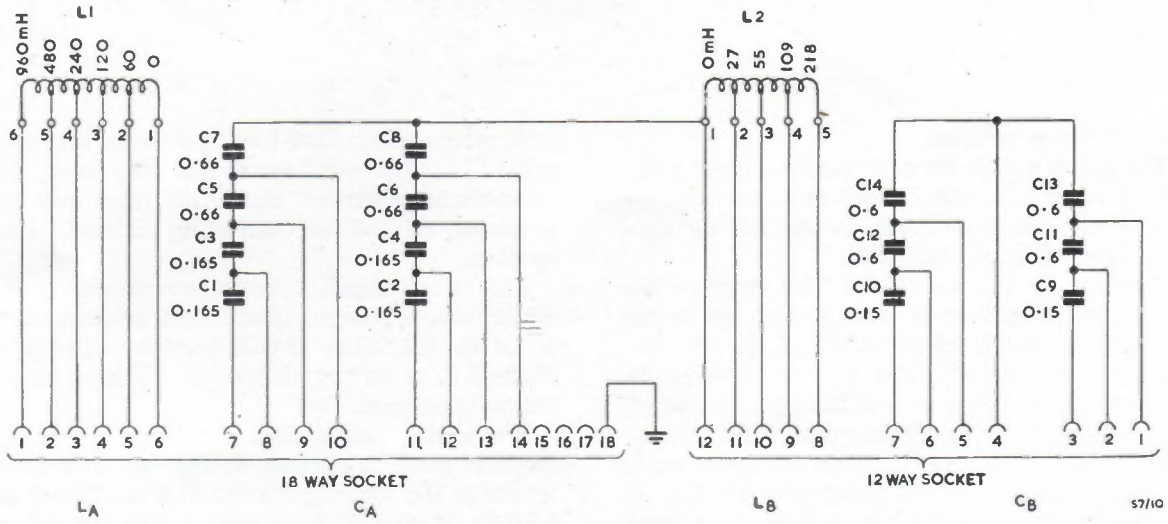


Fig. 2.4.6. Effects Unit EU/1A: Connections

Drawing No. EB 9113

Portable Effects Unit PEU/1

The unit is also supplied in portable form under the coding PEU/1. The circuit of the PEU/1 is identical with that of the EU/1A fitted with repeating-coils, although the engraving on the switch-plates of the frequency-characteristic controls is slightly different. The PEU/1 is intended for use at low level in unbalanced microphone circuits in studios other than those employing Type-B Equipment.

SECTION 2.5

MARK II EQUIPMENT: GROUP-SWITCHING, TALKBACK, CLEAN FEED AND CUE-LIGHT CIRCUITS

Channel Group Switches

The group switch on each channel fader panel has a number of contacts which between them:

(a) route the programme to the left or right group (Figs. 1 and 1.5.5),
(b) bring up the red or the blue lamp on the panel according to whether the left or the right group is selected (Fig. 1.5.5),
(c) put the channel-fader off-normal contacts, which are used in the loudspeaker cut-off circuit, onto the correct group (Fig. 2),
(d) prepare the cue-light circuit for operation in accordance with the group selected (Fig. 3).

Note, however, that if the battery fails, all channels are routed via the *left* group.

Functions (a) and (b) of the group switches have already been considered in Part I. Functions (c) and (d) relate to the circuits to be discussed in this Section.

Fader Off-normal Loudspeaker Cut-off Circuit (Figs. 1 and 2)

Purpose

This circuit is arranged to cut off the appropriate studio loudspeaker feed when a microphone in the main or the narrator's studio is live.

Main Studio Loudspeaker

The feed to the main-studio loudspeaker is controlled by relay SLS as shown in Fig. 1. Under the *Tone*, *Rehearsal*, or *Transmission* condition relay SLS is normally operated, and the loudspeaker thus receives an input, provided that all the studio microphones are faded out at the appropriate channel or group controls. The operating loop for the relay (Fig. 2) is from earth to battery and thence via a 1·5-kilohm resistor through the two 53-ohm windings in parallel and back to earth. If a microphone is faded up, an earth is extended through the selected group-fader off-normal contacts, the channel group switch, and the channel-fader off-normal contacts to the sleeve of the channel input jack. The earth thence passes via a cord circuit to the sleeve of the programme source jack, relay contact LSA-1 and a 6·8-ohm resistor to relay SLS. The windings of this relay being thus short-circuited via 6·8 ohms, the relay falls out, so cutting off and short-circuiting the studio loudspeaker.

The sleeve circuit operates on channel 8 if a microphone is plugged up and the *Mic./Gram* switch is set to *Mic.* The circuit does not operate on channel 9, or on any channel to which an outside source is plugged.

When the *Studio L.S.* toggle-switch on the monitor panel is thrown to *Off*, an earth is extended to the winding of relay SLS via TTO-3 and LSA-1, causing SLS to release and cut off the loudspeaker feed even although no microphone in the studio is alive.

Relays TTO and LSA are concerned in the talkback circuit, which is covered under a subsequent heading.

Narrator's Studio Loudspeaker

The feed to the narrator's studio loudspeaker is controlled by relay NLS. (Fig. 1.) This relay is normally operated, and the loudspeaker thus receives an input, provided that the narrator's channel is faded out. The battery operating loop for the relay (Fig. 2) is similar to that for relay SLS as previously described. If the narrator's microphone is faded up, an earth is extended through the channel fader off-normal contacts, relay contact LSA-3 and a 6·8-ohm resistor to relay NLS; this relay falls out, so cutting off and short-circuiting the narrator's studio loudspeaker.

In contrast to the circuit of relay SLS, that of relay NLS does not embrace group-fader contacts or jack-sleeves and cords, although the release of the relay in the *Off* position of the *Studio L.S.* toggle-switch does also apply.

Anti-click Precautions

Precautions are taken to stop clicks from being picked up on the programme leads of cords due to switching transients in the sleeve circuits. Firstly, the 1·5-kilohm resistors R10 and R11 are inserted

in the battery loops to reduce the d.c. voltage available across the SLS and NLS relay windings and so minimise the surge resulting from the sudden application of an earth. Secondly, the time constants of the combinations C3-R8 and C4-R9 are chosen with a view to click suppression.

Talkback Circuit (Figs. 1 and 2)

Rehearsal Talkback to Studio

When the *Rehearsal* button (Fig. 2.1.3) is pressed, relay RH operates.

RH-1 prepares a circuit for the operation of relay LSO (Fig. 2) via the right-hand or the left-hand *Studio Talkback* key.

When either *Studio Talkback* key is thrown, relay LSO operates.

LSO-1/2 opening cut off the cubicle loudspeaker.

LSO-3 operates relays LSA and MCO.

LSA-1 opening prevents an earth from being applied to the winding of relay SLS, thus ensuring that this relay remains operated and that the studio loudspeaker is therefore on.

LSA-2 provides a direct earth in the operating path of relay MCO.

LSA-3 opening ensures that relay NLS is operated and the narrator's loudspeaker on.

MCO changing over disconnects the programme chain from the input to the main (No. 19) amplifier and substitutes the talkback chain.

At Bush House, relay AGC (Fig. 2) is energised in parallel with relay MCO. The contacts AGC-1/2 change over and disconnect the acoustic-gram effects circuit from the studio loudspeaker. (Fig. 1.5.3b.)

When the *Studio Talkback* key is released to normal, relays LSA and MCO fall out before relay LSO, which is designed with a release lag of some 400 milliseconds as a precaution against howl-round via the talkback microphone and cubicle loudspeaker.

Transmission Talkback to Studio

Under the *Transmission* condition, relay RH is not operated. When a *Studio Talkback* key is thrown, relays TTM and TTO now operate via RH-1. (Fig. 2.) TTM connects the output of the talkback amplifier No. 17 to the input of the transmission talkback amplifier No. 18 (Fig. 1), while TTO-1/2 connect the output of amplifier No. 18 to the studio headphones and cue programme circuits and, provided that the appropriate faders are faded out, to the studio and narrator's loudspeakers; TTO-3 completes the earth loop of relay CDM, which dims the cubicle loudspeaker.

Note that, from the point of view of talkback circuit operation, the *Tone* condition may be considered as identical with the *Transmission* conditions.

Clean Feed (Figs. 1 and 2)

When the *Clean Feed* key (Fig. 2) is thrown to *Clean Feed*, relays TW and TWL operate, and a circuit is prepared for operating relay TWT via the *Clean Feed Talkback* key and contacts of the *Rehearsal* pushbutton.

TW switches the 'incoming contribution output' routed via the right group direct channel and amplifier No. 12 to the studio headphones. (Fig. 1.) The operating circuit of relay TW is so arranged that the relay will release should either *Studio Talkback* key be depressed.

TWL-1/2 switch the clean feed to line.

Depressing the *Clean Feed Talkback* key operates relay CDM and, under *Rehearsal* conditions only, relay TWT via the *Clean Feed* key.

CDM dims the cubicle loudspeaker.

TWT-1 connects amplifier No. 17 output to amplifier No. 11 input, thus permitting rehearsal talkback on the clean feed line.

When the *Clean Feed* key is thrown to *C.F. + T.T.B.*, relays TW and TWL operate as before, and a circuit is prepared for operating relay TWT via the *Clean Feed Talkback* key under both *Rehearsal* and *Transmission* conditions. (The *Tone* condition, as already stated, is from this aspect identical with the *Transmission* condition.)

For details of a non-standard clean feed talkback circuit used at Bush House, London, see Fig. 10 and the note on page 22 of Part I.

Cue-Light Circuits (Fig. 3)

The 230-volt a.c. supply to the 15-watt cue-lights is controlled by relays GR1 to GR7, MIC/GRAM, GR9, NARR and MCL. (Fig. 3.) Cue-light relays GR1 to GR7 and MIC/GRAM may be switched to any of the channels 1 to 8 or to *Off* by means of switches on the cue selection panel; these relays are also connected to either the left or the right group in accordance with the settings of the group selection switches on the channel fader panels. Relay GR9 is permanently tied to channel 9; relay NARR cannot be associated with either group and is permanently tied to the narrator's channel; relay MCL operates wall-mounted cue-lamps via the master key on the main fader panel.

All the relays, unless switched to *Off*, can be

operated by throwing the master cue-light key. Any individual relay can also be operated by the channel cue-light key on the appropriate channel fader panel. Relays GR1 to GR7 and MIC/GRAM can further be operated by the left group cue key via relay LC or LD, or by the right group cue key via relay RC or RD; these group cue keys are mounted on the respective group fader panels.

On channel 8, the cue-light circuit is routed via the cue selection switch so long as the toggle-switch on the fader panel is set to *Mic.*, but if the toggle-switch is thrown to *Gram*, relays NGA, NGB and CLC operate, changing over the source from Mic. to Gram as shown in Fig. 1 and connecting the cue-light key in parallel with that of channel 9.

All the cue-light keys light local 6-volt pilot-lamps on the fader panels, and it is important that the key contact operating the cue-light relay should make not later than the key contact operating the corresponding green pilot-lamp. The operator can then assume with confidence that provided the pilot-lamp lights the key has been depressed sufficiently to operate the cue-light relay.

SECTION 2.6

MARK I EQUIPMENT: TALKBACK, CLEAN FEED AND CUE-LIGHT CIRCUITS

Fader Off-normal Loudspeaker Cut-off Circuit (Figs. 7 and 8)

Comparison with Mark II Equipment

This circuit, shown in Figs. 7 and 8, is broadly similar to the corresponding circuit used with the Mark II equipment as shown in Figs. 1 and 2. The only differences are:

(a) As the Mark I equipment has no narrator's loudspeaker, relay NLS with its associated circuits is not used.

(b) As there are no group switches, the earth loop of the off-normal circuits is completed via an auxiliary contact on the main gain-control fader instead of via a group fader.

Circuit Operation

The feed to the studio loudspeaker is controlled by relay **SLS** as shown in Fig. 7. Under the *Tone*, *Rehearsal* or *Transmission* condition relay **SLS** is normally operated, and the loudspeaker thus receives an input, provided that all the studio microphones are faded out at the main or channel controls. The operating loop for the relay (Fig. 8) is from earth to battery and thence via a 1·5-kilohm resistor through the two 53-ohm windings in parallel and back to earth. If a microphone is faded up, an earth is extended via the main and channel fader off-normal contacts, relay contact **LSA**-1 and a 6·8-ohm resistor to relay **SLS**. The windings of this relay being thus short-circuited via 6·8 ohms, the relay falls out, so cutting off and short-circuiting the studio loudspeaker.

When the *Studio L.S.* toggle-switch on the monitor panel is thrown to *Off*, an earth is extended to the winding of relay SLS via TTO-3 and LSA-1, causing SLS to release and cut off the loudspeaker feed even although no microphone in the studio is alive.

Relays TTO and **LSA** are concerned in the talkback circuit, which is covered under the next heading.

Talkback Circuit (Figs. 7 and 8)

Comparison with Mark II Equipment

This circuit differs from that of the Mark II equipment by virtue of there being no narrator's loudspeaker. Hence the contacts of the NLS relay fitted in box-RLB/47A are not wired.

Rehearsal Talkback to Studio

When the Rehearsal button (Fig. 2.1.3) is pressed, relay RH operates.

RH-1 prepares a circuit for the operation of relay LSO (Fig. 8) via the right-hand or the left-hand *Studio Talkback* key.

When either *Studio Talkback* key is thrown, relay **LSO** operates.

LSO-1/2 opening cut off the cubicle loudspeaker.

LSO-3 operates relays LSA and MCO.

LSA-1 opening prevents an earth from being applied to the winding of relay **SLS**, thus ensuring that this relay remains operated and that the studio loudspeaker is therefore on.

LSA-2 provides a direct earth in the operating circuit of relay MCO.

MCO changing over disconnects the programme chain from the input to the main amplifier and substitutes the talkback chain.

When the *Studio Talkback* key is released to normal, relays LSA and MCO fall out before relay LSO, which is designed with a release lag of some 400 milliseconds as a precaution against howl-round via the talkback microphone and cubicle loudspeaker.

Transmission Talkback to Studio

Under the *Transmission* condition, relay RH is not operated. When a *Studio Talkback* key is thrown, relays TTM and TTO now operate via RH-1. (Fig. 8.) TTM connects the output of the talkback amplifier to the input of the transmission talkback amplifier (Fig. 7), while TTO-1/2 connect the output of the transmission talkback amplifier to the studio headphones and cue programme circuits and, provided that all microphones are faded out, to the studio loudspeaker. TTO-3 completes the earth loop of relay CDM, which dims the cubicle loudspeaker.

Note that, from the point of view of talkback circuit operation, the *Tone* condition may be considered as identical with the *Transmission* condition.

Clean Feed (Figs. 7 and 8)

Comparison with Mark II Equipment

The clean feed arrangement in the Mark I equipment (Fig. 7) differs somewhat from that in the Mark II (Fig. 1), as explained in Sections 1.5 and 1.7. Apart, however, from the introduction of a red indicator-lamp operated by the *Clean Feed* key and the use of additional contacts of relay TWL in the Mark I equipment, the switching circuits (Figs. 2 and 8) of both equipments are the same.

Circuit Operation

When the *Clean Feed* key (Fig. 8) is thrown to *Clean Feed*, relays TW and TWL operate, and a circuit is prepared for operating relay TWT via the *Clean Feed Talkback* key and contacts of the *Rehearsal* pushbutton; the red indicator-lamp adjacent to the *Clean Feed* key also lights.

TW switches the incoming contribution out line to the studio headphones.

TWL-1/2 re-route the programme incoming on outside source line 1 from channel 2 to channel 7.

TWL-3/4 switch the clean feed to the outgoing clean feed line.

Depressing the *Clean Feed Talkback* key operates relay CDM and, under *Rehearsal* conditions only, relay TWT via the *Clean Feed* key.

CDM dims the cubicle loudspeaker.

TWT connects the talkback microphone amplifier to the clean feed line amplifier, thus permitting rehearsal talkback on the clean feed line.

When the *Clean Feed* key is thrown to *C.F.* + *T.T.B.*, relays TW and TWL operate as before, and a circuit is prepared for operating relay TWT via the *Clean Feed Talkback* key under both *Rehearsal* and *Transmission* conditions. (The *Tone* condition, as already stated, is from this aspect identical with the *Transmission* condition.)

For details of a non-standard clean feed talkback circuit used at Bush House, London, see Fig. 10 and the note on page 31 of Part I.

Cue-Light Circuits (Fig. 9)

The cue-light circuits of the Mark I equipment are shown in Fig. 9. The cue-light key on each channel fader panel operates a specific 230-volt 15-watt green cue-light in the studio, together with a 6-volt green indicator-lamp on the panel.

By comparison with the arrangement employed in the Mark II equipment, only four cueing circuits are provided instead of eleven. The cue selection panel, master cue and group selection facilities and mic./gram change-over circuits provided with the Mark II equipment are also omitted.

SECTION 2.7

SPECIAL MICROPHONE CIRCUITS

General

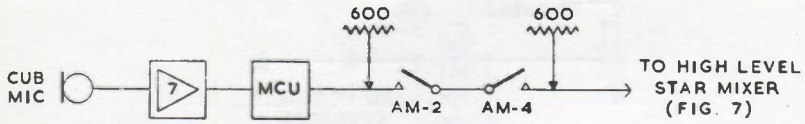
Three special microphone circuits are installed at Bush House, London. These are:

1. Studio cubicle announcer's microphone circuit,
2. Emergency microphone switching circuit,
3. Microphone cut-off circuit.

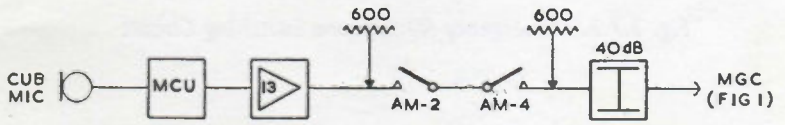
Studio Cubicle Announcer's Microphone Circuit

This circuit is used principally for English opening and closing announcements to foreign-language programmes. It is provided at Bush House on all Mark I equipments and on certain Mark II equipments also. There are minor differences between Mark I and Mark II.

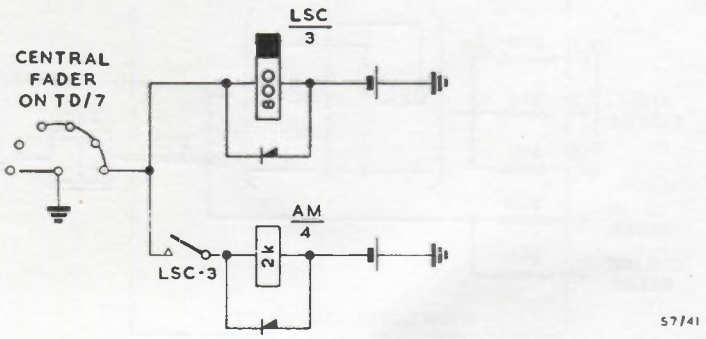
An announcer's microphone is provided in the cubicle and is controlled by the normally-unused central fader knob on the studio TD/7 desk, wired for the purpose as a switch; the fader controls two relays, LSC and AM, which are mounted in a relay box RLB/49X1 or, where acoustic-gram effects are also provided, in a relay box RLB/49X3. Turning up the fader operates relay LSC. (Fig. 2.7.1.)



(a) MARK I EQUIPMENT PROGRAMME CIRCUIT



(b) MARK II EQUIPMENT PROGRAMME CIRCUIT



(c) SWITCHING CIRCUIT

Fig. 2.7.1. Studio Cubicle Announcer's Microphone Circuit

LSC-1/2 open and cut the cubicle loudspeaker prior to the *L.S. Vol.* control. (Figs. 1 and 7.)

LSC-3 operates relay AM. (Fig. 2.7.1.)

AM-1 cuts the studio cubicle buzz-out buzzer. (Fig. 4.)

AM-2/4 connect the cubicle microphone. (Fig. 2.7.1.)

AM-3 cuts the cubicle telephone buzzer. (Fig. 5.)

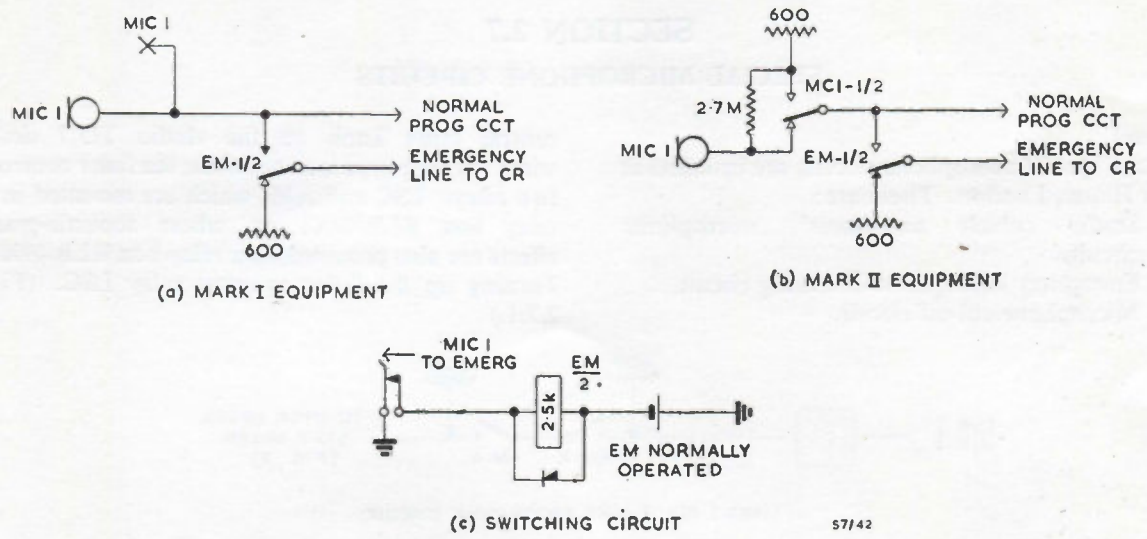


Fig. 2.7.2. Emergency Microphone Switching Circuit

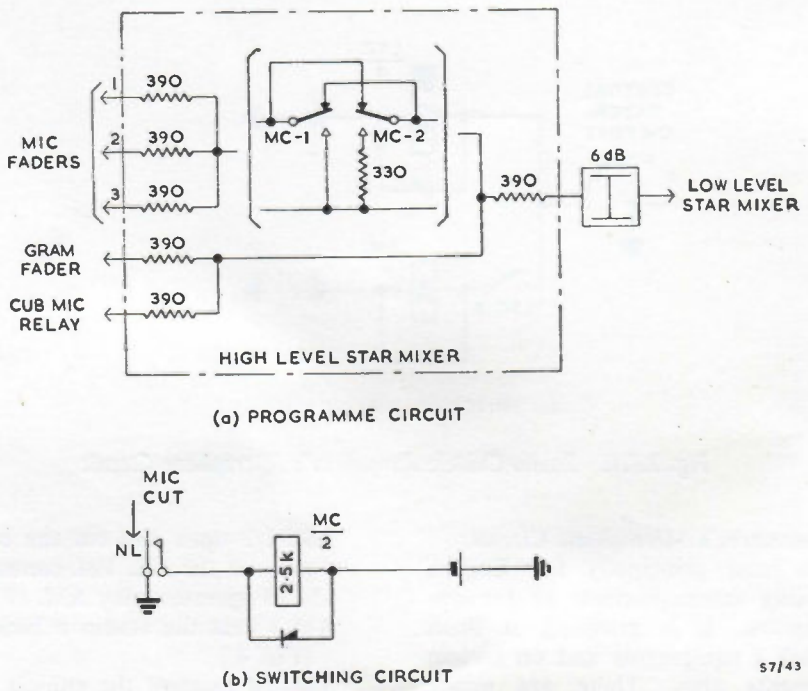


Fig. 2.7.3. Mark I Equipment: Microphone Cut-off Circuit

Emergency Microphone Switching Circuit

This circuit allows studio microphone No. 1 to be switched to the emergency line to control room by means of a key on the cubicle desk and also ensures that the microphone is switched to this line in the event of a failure of the 50-volt supply.

The key, labelled *Mic. 1 to Emergency*, is fitted at the bottom left-hand corner of the monitor panel on the desk, in place of the blank appearing in Fig. 1.2.5. The key is in the battery circuit of a miniature sealed relay EM, normally held operated, and depressing the key releases the relay. (Fig. 2.7.2.) EM-1/2 then connect microphone No. 1 to the emergency line in place of a 600-ohm termination. If the cubicle 50-volt supply should fail, relay EM similarly releases and EM-1/2 switch over as before.

The relay contacts MC1-1/2 on the Mark II equipment, shown at (b) in Fig. 2.7.2, form part of the microphone cut-off circuit described under the next heading.

Microphone Cut-off Circuit

This circuit disconnects all microphones in the studio when a non-locking push-key fitted on the studio talks table and labelled *Mic. Cut* is pressed.

On Mark I equipment, the cut is effected by applying a short-circuit to the studio microphone circuits in the middle of the high-level star mixer. Operation of the key energises relay MC. (Fig. 2.7.3.)

MC-1 shorts out the three studio microphones, but not the cubicle microphone, outside sources or grams.

MC-2 applies a compensating load of 330 ohms to the star mixer.

On Mark II equipment, the *Mic. Cut* key operates one MC relay per microphone circuit installed, these relays being energised in parallel. The contacts of MC1, the relay for No. 1 microphone, are shown in Fig. 2.7.2(b). When the relay is operated, MC1-1/2 interrupt the circuit prior to the microphone correction unit (Fig. 1) and apply a shunt of 600 ohms to the input of the M.C.U. A 2·7-megohm anti-click resistor is introduced as shown. The cut-off circuit is effective both under normal conditions and when microphone No. 1 is switched to the emergency line.

G.H. 3/60

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in ***Instruction***

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Station..... *Date*..... *Signature*.....

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in ***Instruction***

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Station..... *Date*..... *Signature*.....

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in ***Instruction***

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Station..... *Date*..... *Signature*.....

ERRATA

To Editor,

Technical Instructions,

305, *St. Hilda's, Maida Vale.*

The following errors have been noted in ***Instruction***

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Station..... *Date*..... *Signature*.....

FIG 1
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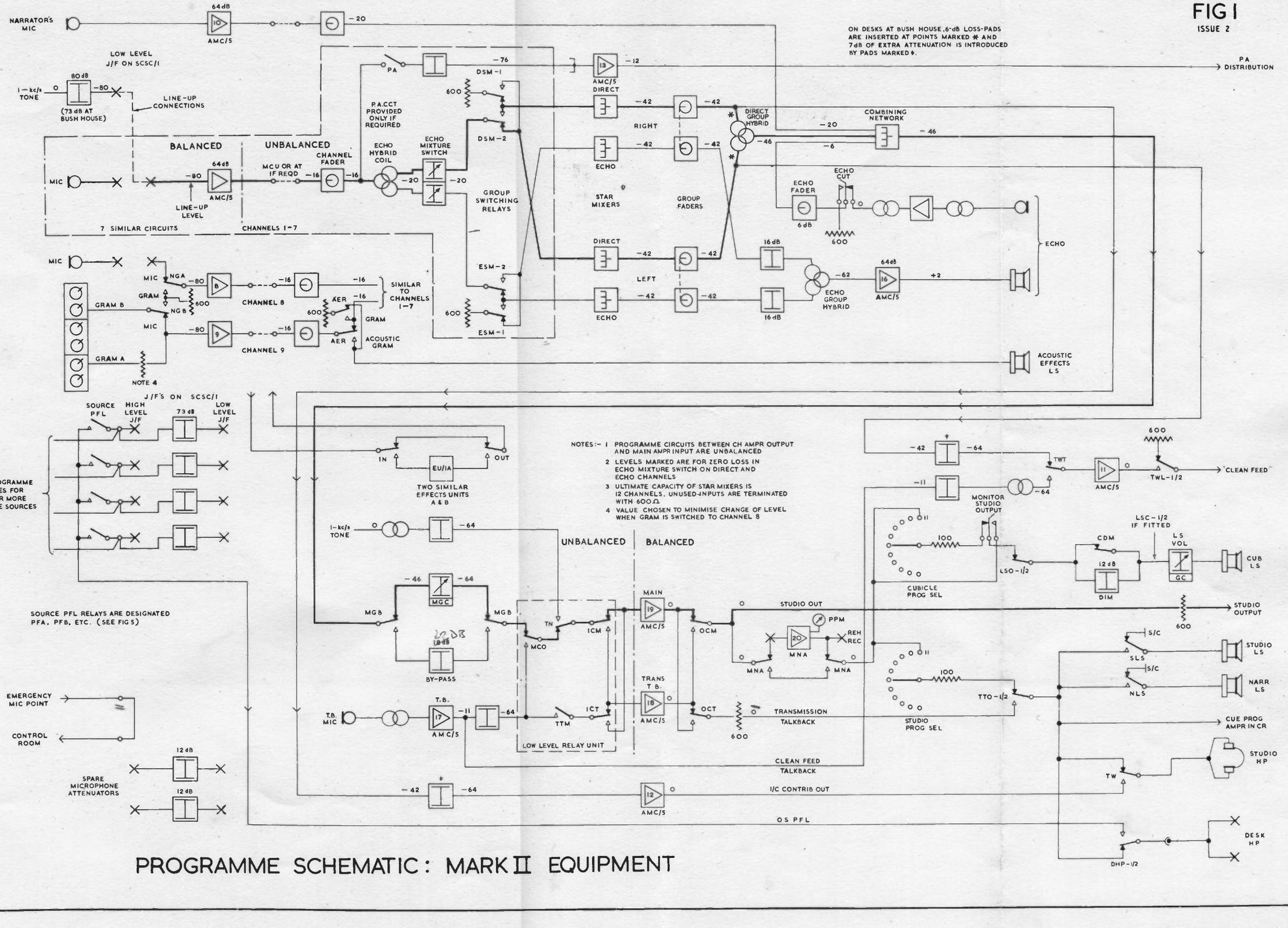
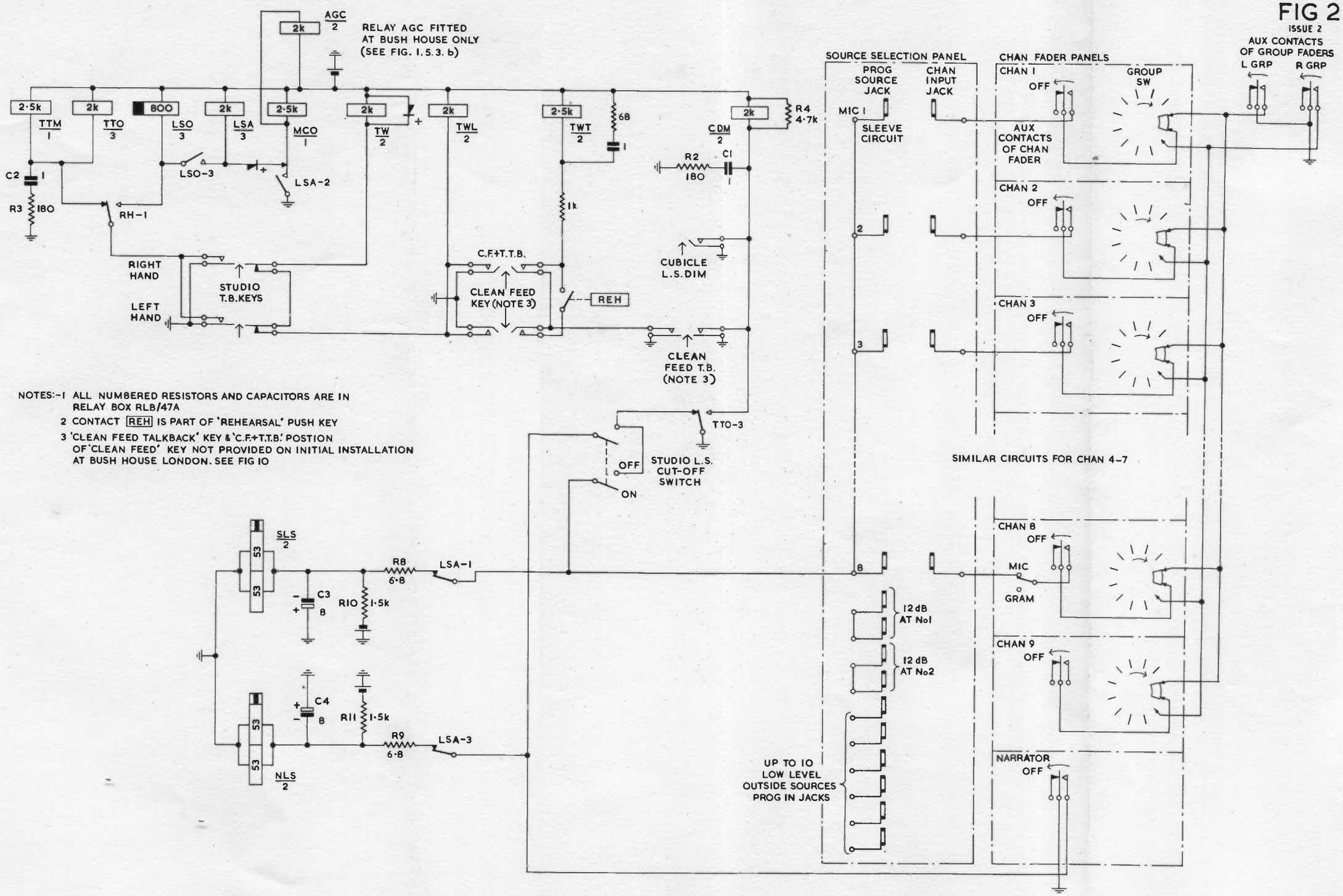


PROGRAMME SCHEMATIC: MARK II EQUIPMENT

FIG 2
ISSUE 2



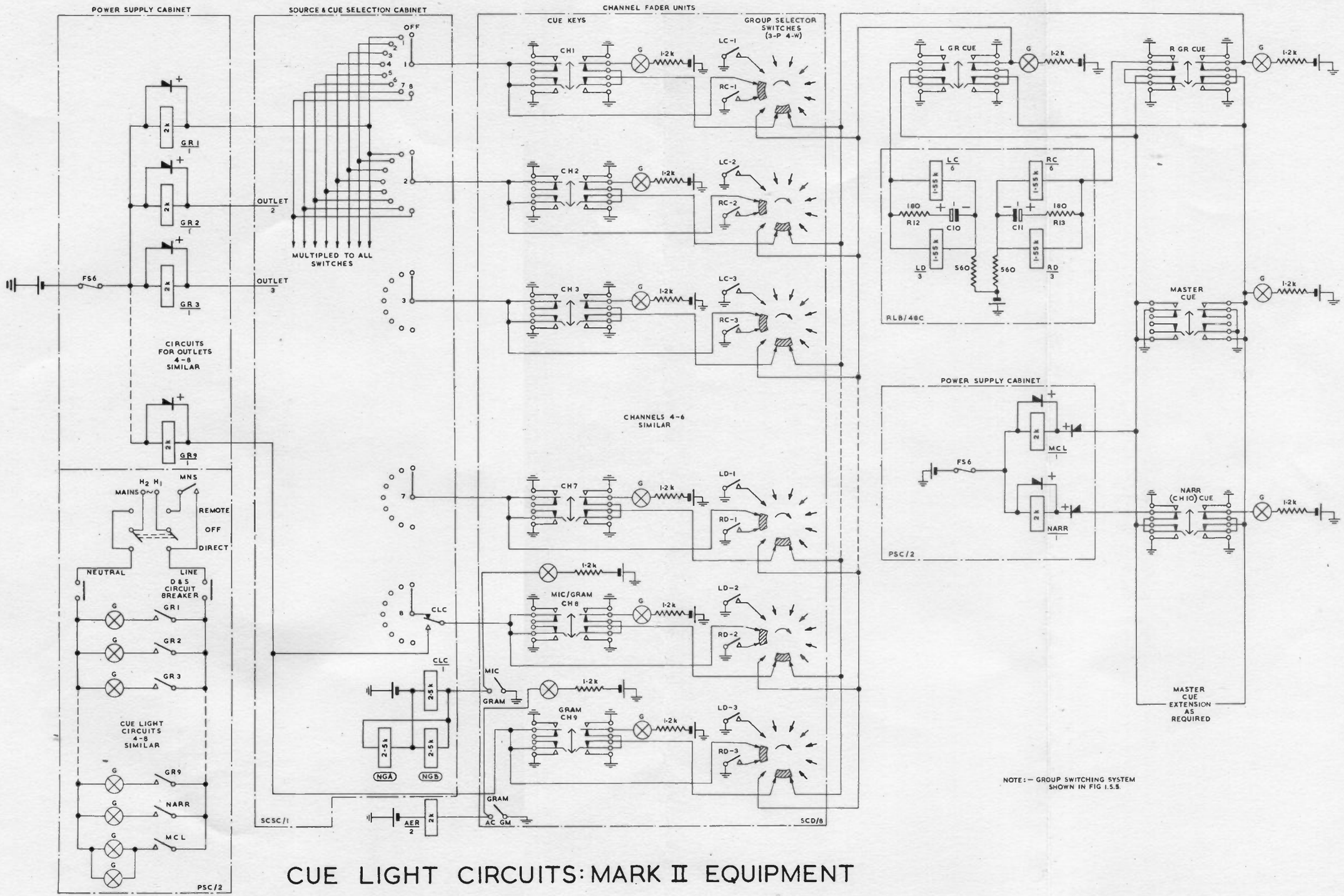
NOTES:-1 ALL NUMBERED RESISTORS AND CAPACITORS ARE IN RELAY BOX RLB/47A

2 CONTACT [REH] IS PART OF 'REHEARSAL' PUSH KEY

3 'CLEAN FEED TALKBACK' KEY & 'C.F+T.T.B.' POSTION OF 'CLEAN FEED' KEY NOT PROVIDED ON INITIAL INSTALLATION AT BUSH HOUSE LONDON. SEE FIG 10

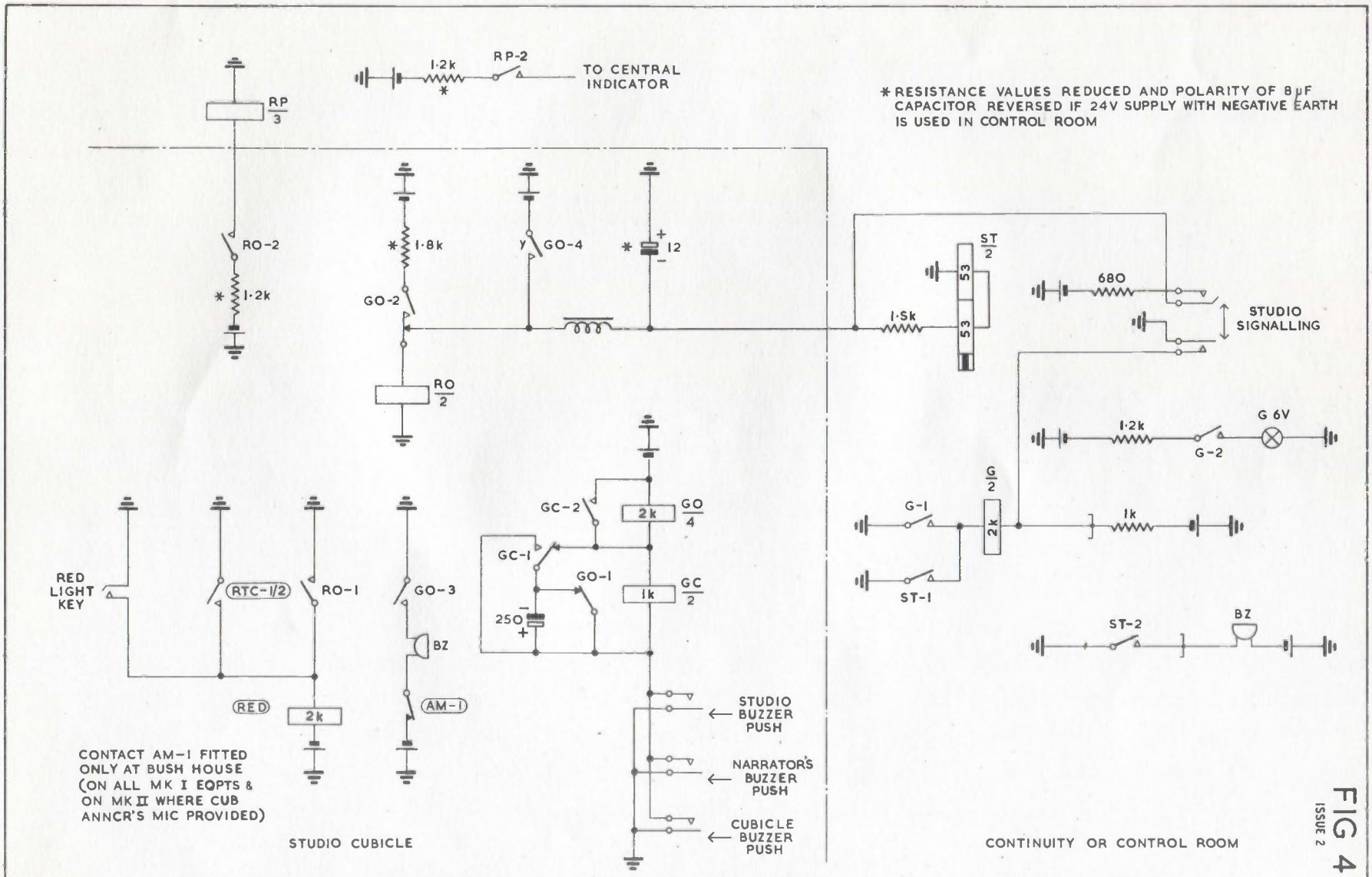
STUDIO LOUDSPEAKER CUT-OFF AND TALKBACK CIRCUIT: MARK II EQUIPMENT

FIG 3
ISSUE 2



NOTE:— GROUP SWITCHING SYSTEM SHOWN IN FIG 1.5.5.

CUE LIGHT CIRCUITS: MARK II EQUIPMENT

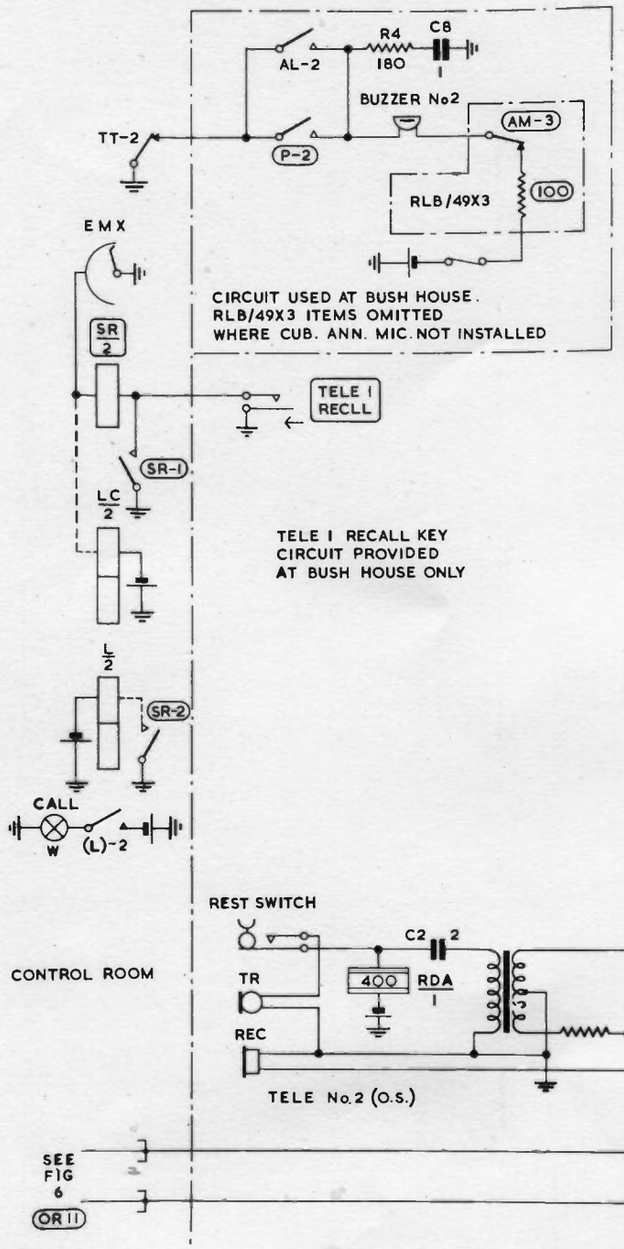


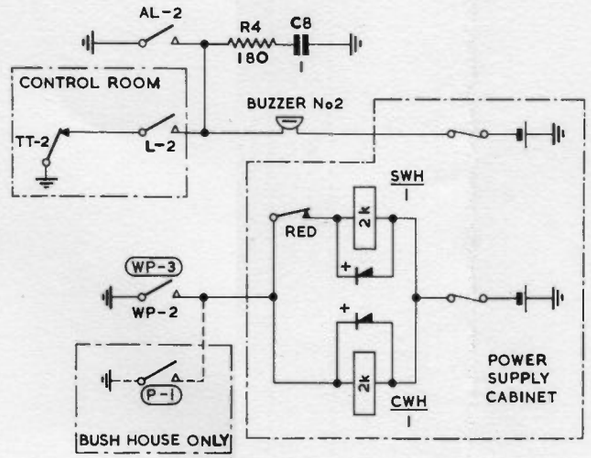
STUDIO RED LIGHT AND CONTROL ROOM SIGNALLING CIRCUIT

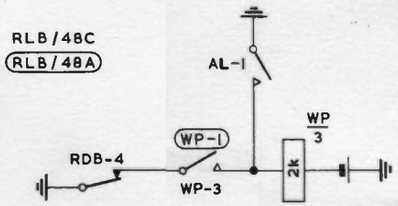
FIG 4
ISSUE 2

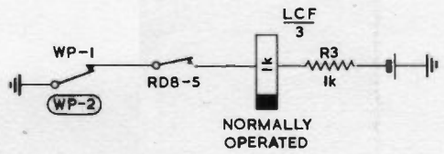
S7

FIG 5
ISSUE 2

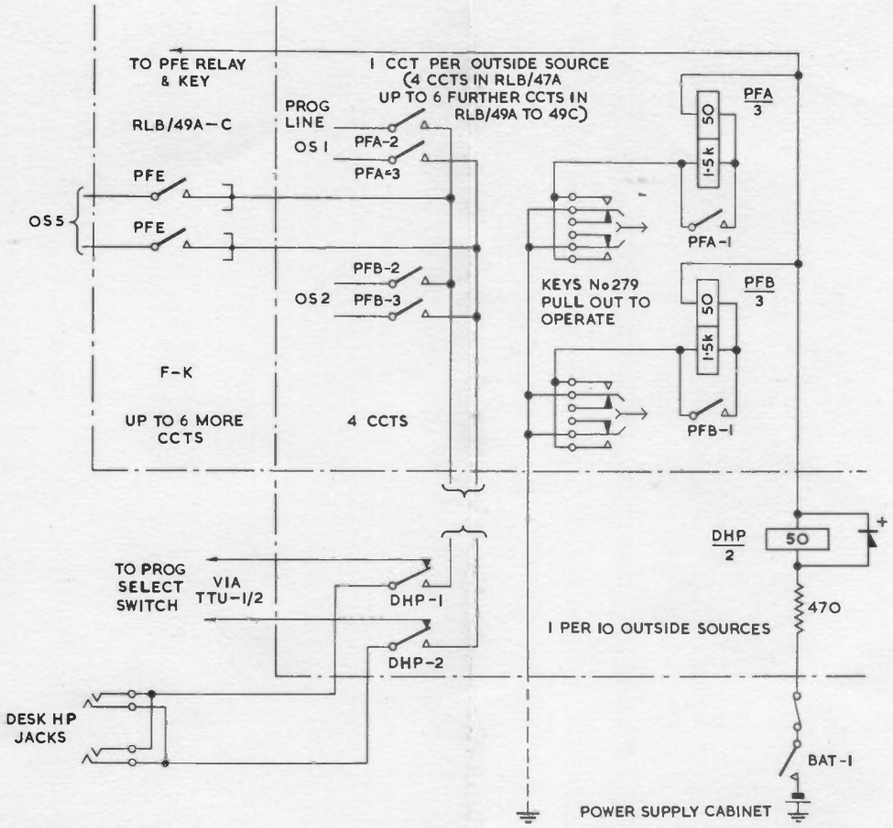


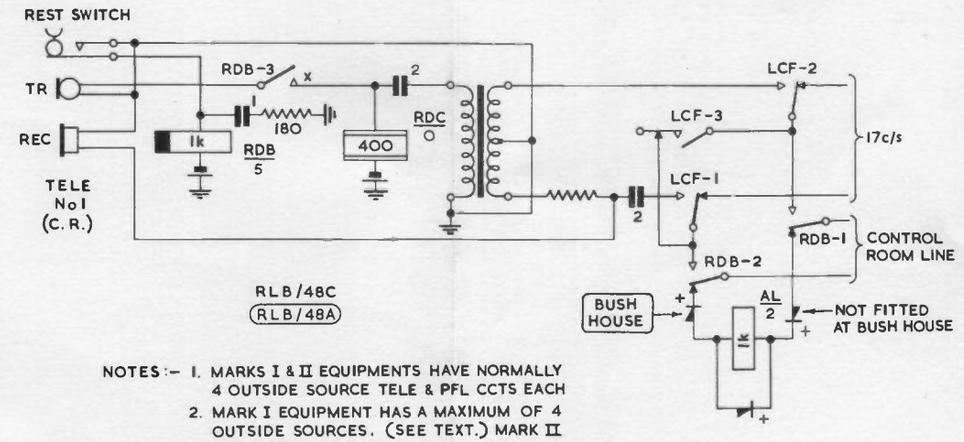






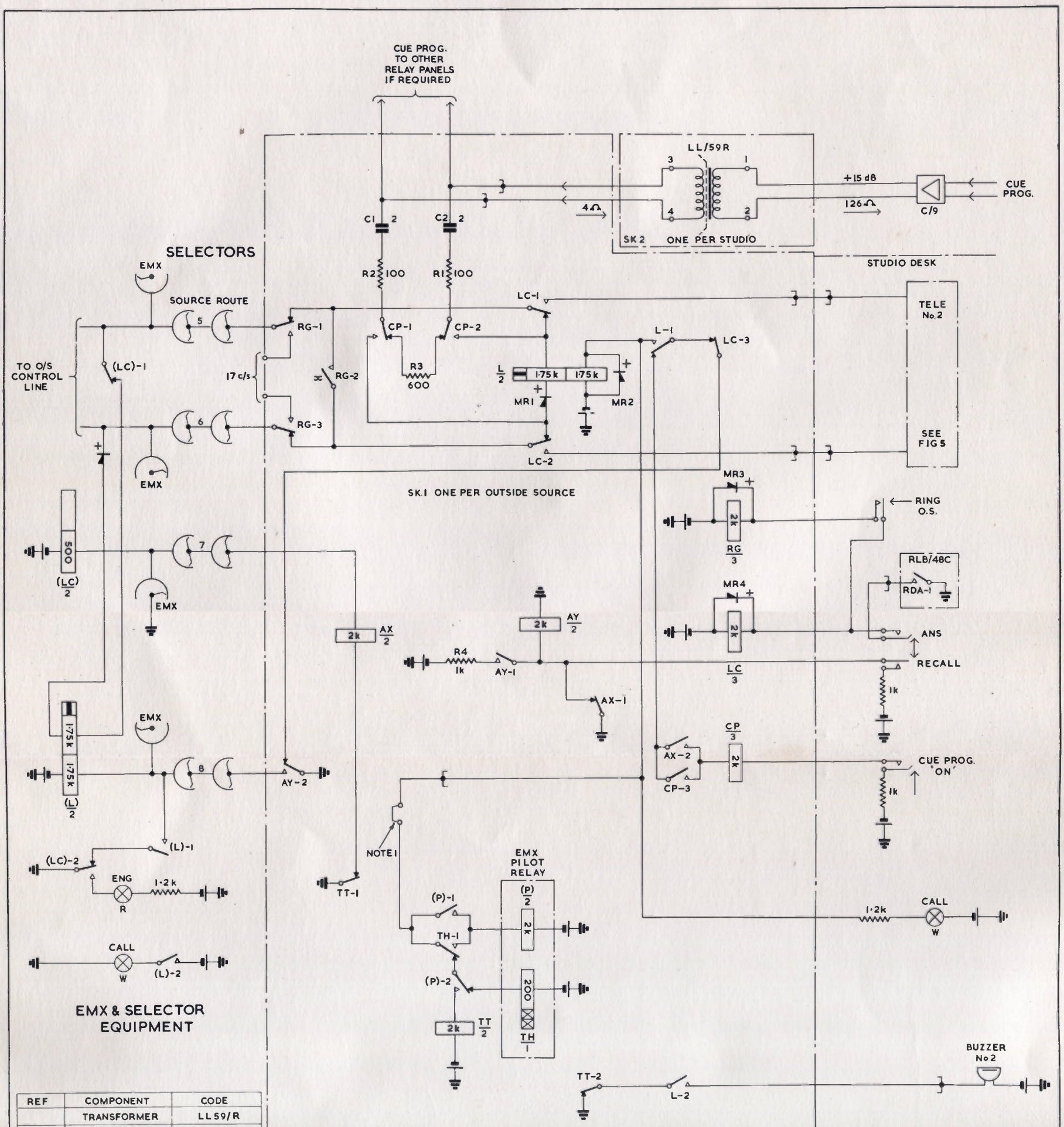
RINGED ITEMS REFER TO BUSH HOUSE ONLY





NOTES:–
1. MARKS I & II EQUIPMENTS HAVE NORMALLY 4 OUTSIDE SOURCE TELE & PFL CCTS EACH
2. MARK I EQUIPMENT HAS A MAXIMUM OF 4 OUTSIDE SOURCES. (SEE TEXT.) MARK II HAS MAXIMUM OF 10
3. CONTACTS OF KEYS No279 INTERCHANGED TO SHOW CIRCUIT OPERATION

TELEPHONE AND P F L CIRCUITS



EMX & SELECTOR EQUIPMENT

CONTROL ROOM RELAY PANELS

STUDIO CUBICLE (SEE ALSO FIG 5)

REF	COMPONENT	CODE
	TRANSFORMER	LL 59/R
MR2–4 MR1	RECTIFIERS RECTIFIER	GEC GEX34 16 K4
C1 C2	CAPACITOR 2 μF	HUNTS B504K
R1 R2 R4 R3	RESISTOR 100 Ω RESISTOR 1k Ω RESISTOR 600 Ω	ERIE TYPE 16 PAINTON MV1 ERIE TYPE 108
TH+(P) TT LC,(LC) RG AX, AY L,(L) CP	RELAY RELAY RELAY RELAY RELAY RELAY RELAY	12303 P.O. 3154 P.O. 3801 P.O. 12206 P.O. 3154 P.O. 3/412E P.O. 3801 P.O.

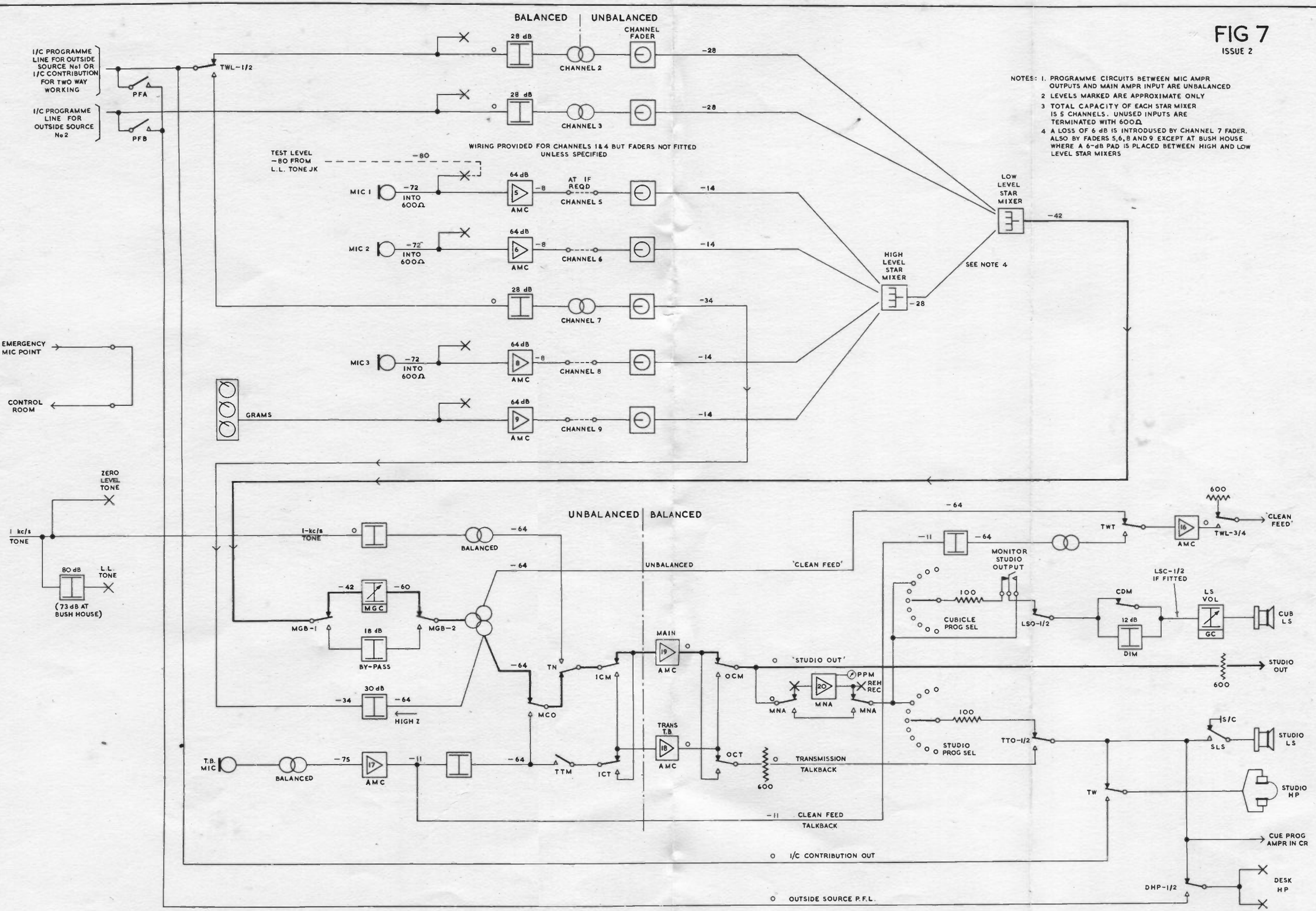
NOTES 1 WHEN DELAYED THROW-BACK FACILITIES ARE NOT REQUIRED DELETE THIS STRAP
2 PA17/9 CONSISTS OF :- SK.1 TWO OFF

FIG 6
ISSUE 2

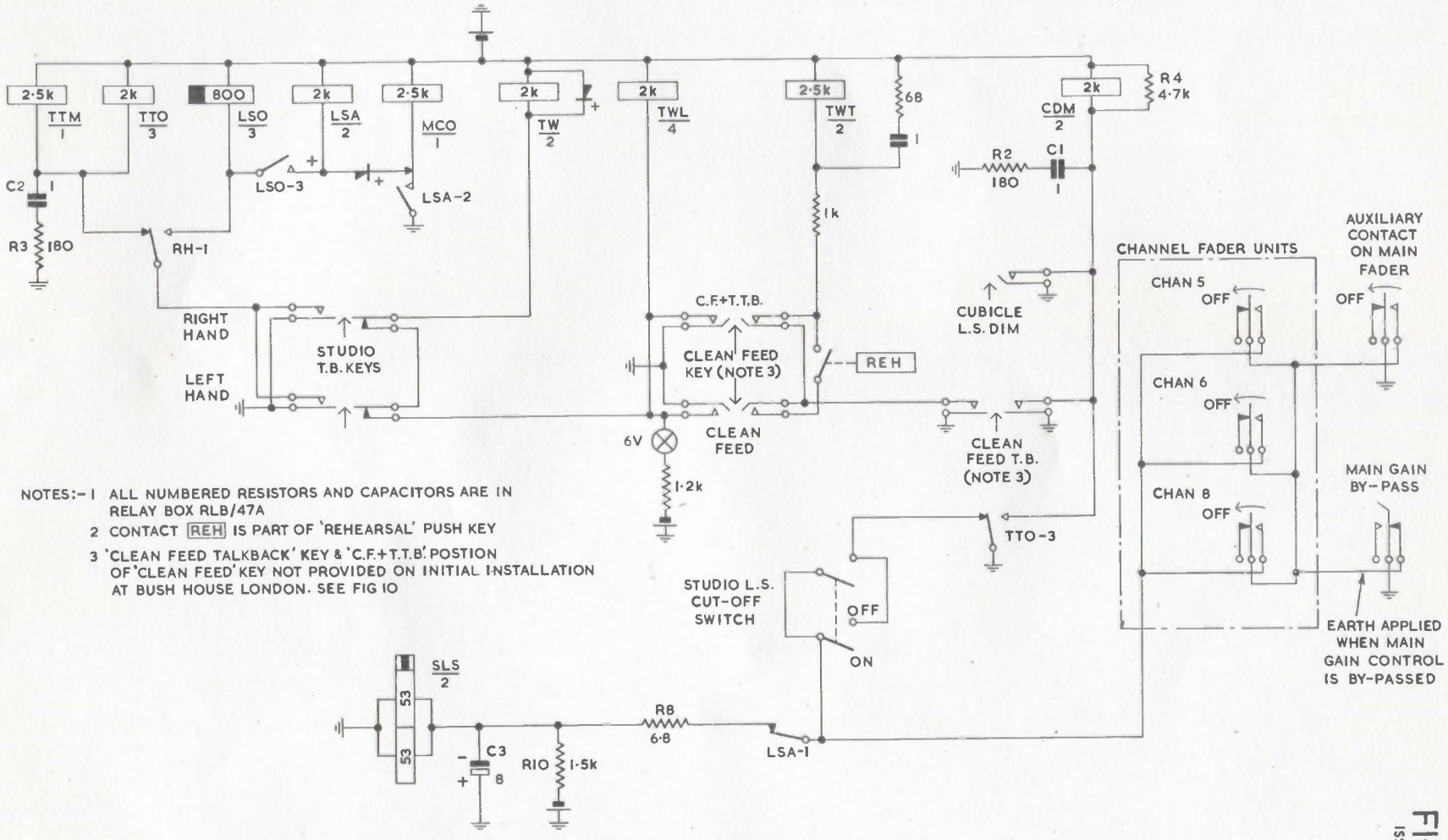
OUTSIDE SOURCE TELEPHONE CALLING & CUE PROGRAMME CIRCUIT

S7

FIG 7
ISSUE 2



PROGRAMME SCHEMATIC: MARK I EQUIPMENT



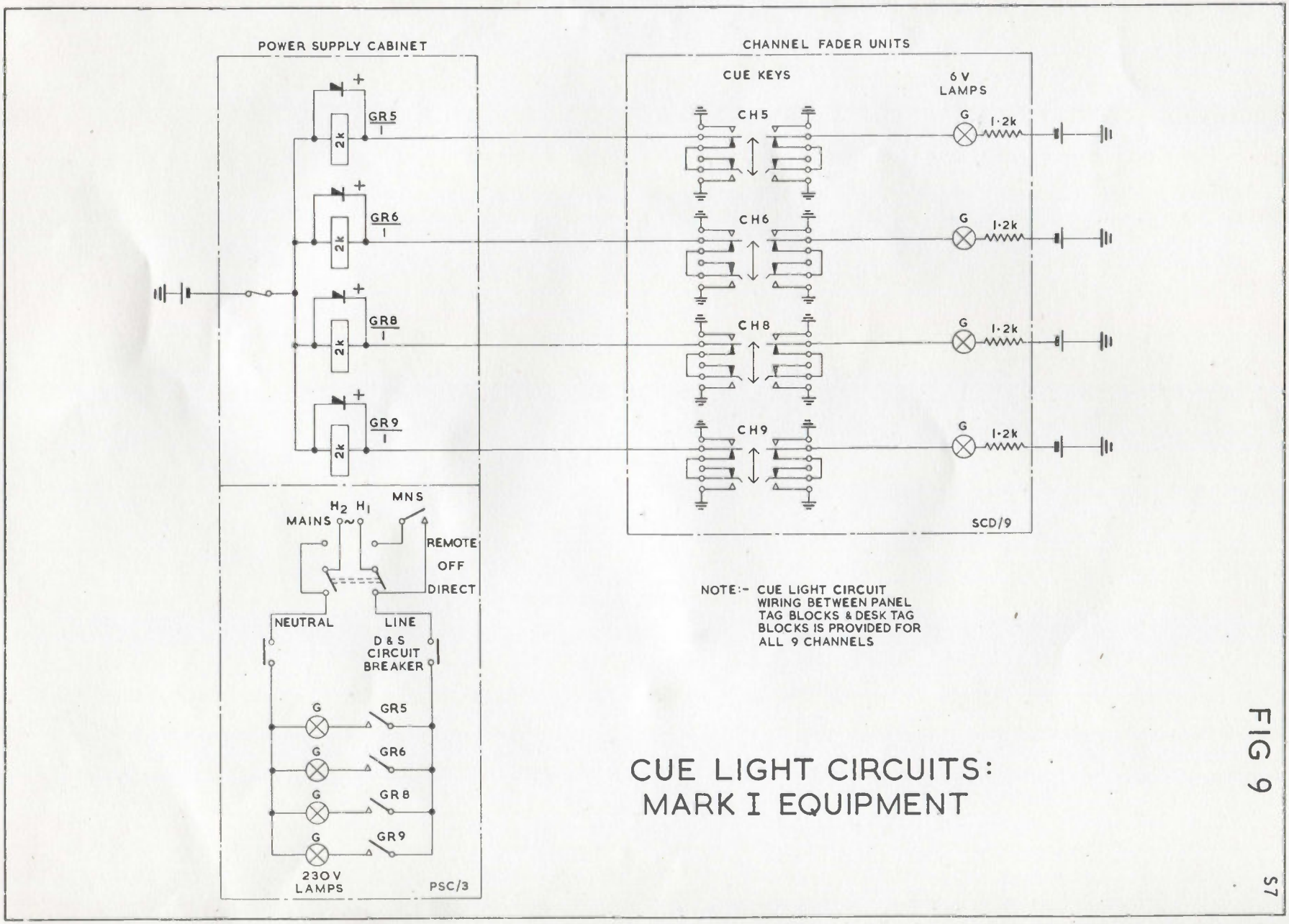
NOTES:- 1 ALL NUMBERED RESISTORS AND CAPACITORS ARE IN RELAY BOX RLB/47A

2 CONTACT REH IS PART OF 'REHEARSAL' PUSH KEY

3 'CLEAN FEED TALKBACK' KEY & 'C.F.+T.T.B.' POSTION OF 'CLEAN FEED' KEY NOT PROVIDED ON INITIAL INSTALLATION AT BUSH HOUSE LONDON. SEE FIG 10

FIG 8 ISSUE 2

STUDIO LOUDSPEAKER CUT-OFF AND TALK BACK CCT: MARK I EQUIPMENT

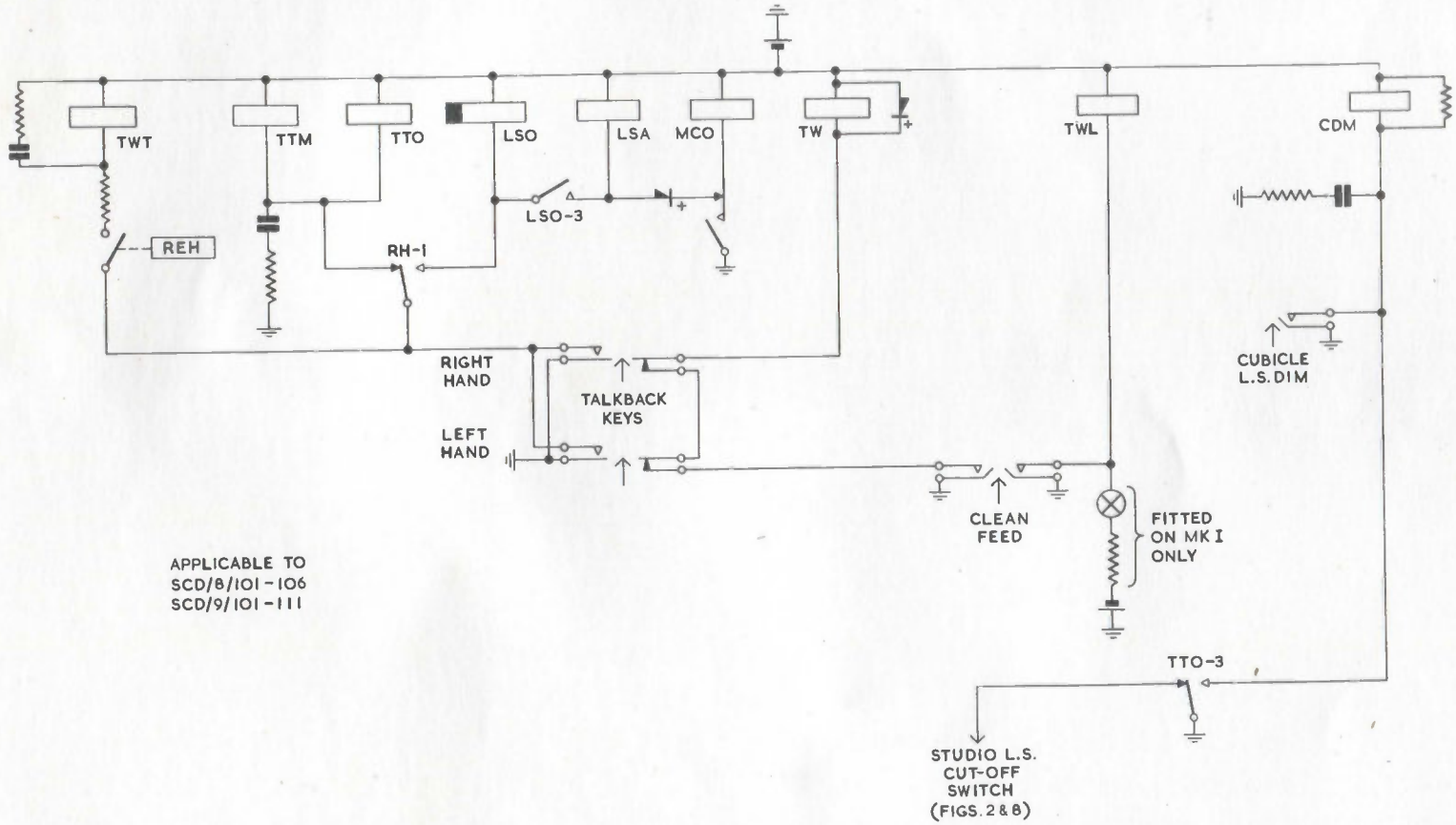


NOTE:- CUE LIGHT CIRCUIT WIRING BETWEEN PANEL TAG BLOCKS & DESK TAG BLOCKS IS PROVIDED FOR ALL 9 CHANNELS

CUE LIGHT CIRCUITS: MARK I EQUIPMENT

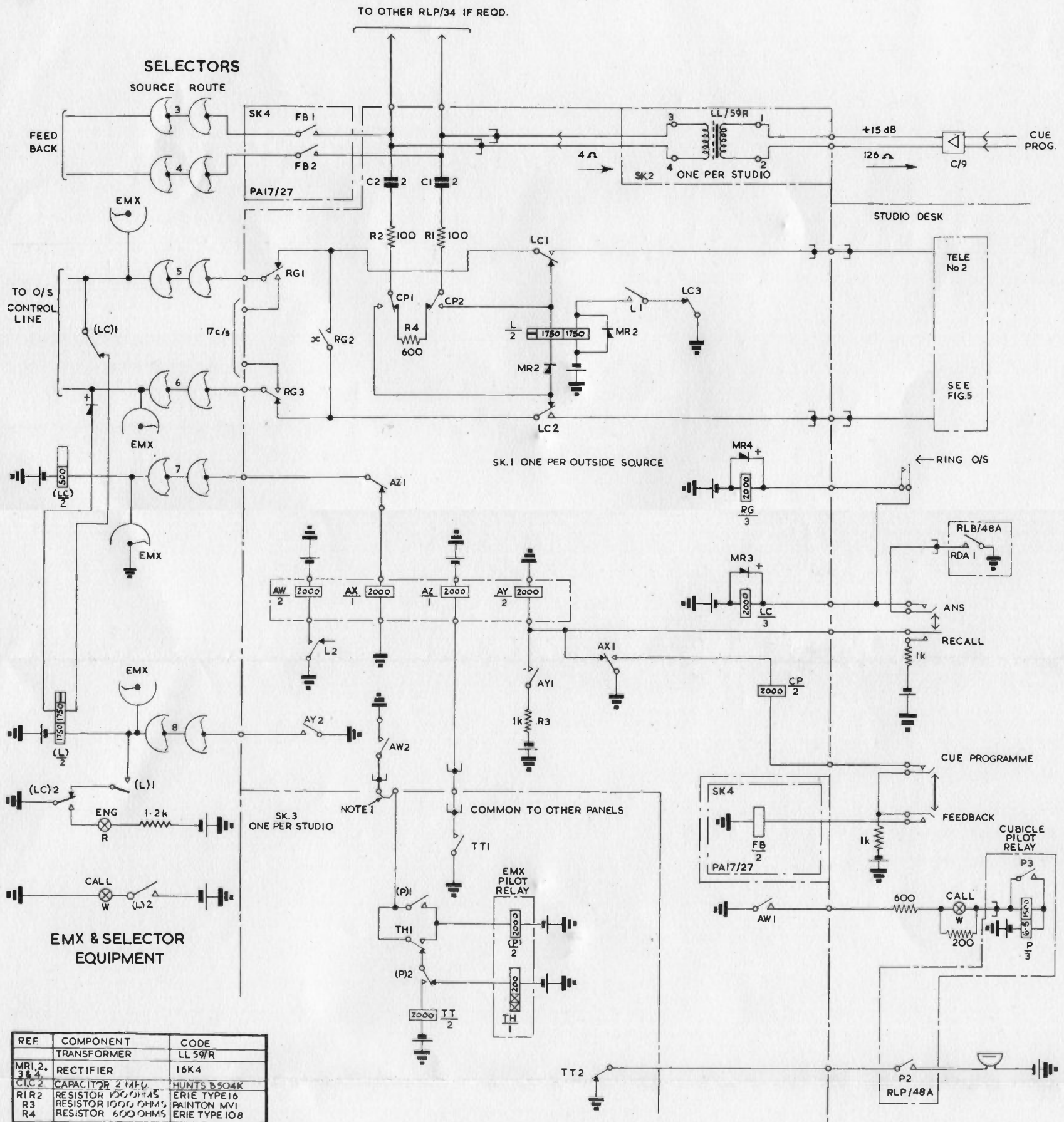
FIG 9

S7



CLEAN FEED & TALKBACK KEYS ON INITIAL INSTALLATIONS AT BUSH HOUSE

FIG 10
ISSUE 2



REF.	COMPONENT	CODE
	TRANSFORMER	LL 59/R
MR1, 2, 3 & 4	RECTIFIER	16K4
C1, C 2	CAPACITOR 2 MFD	HUNTS B504K
R1 R2	RESISTOR 100 OHMS	ERIE TYPE16
R3	RESISTOR 1000 OHMS	PAINTON MV1
R4	RESISTOR 600 OHMS	ERIE TYPE 108
TH+(P) TT LC,(LC) RG A(WYXZ) L,(L) CP	RELAY	12303 P.O. 3154 P.O. 3801 P.O. 12206 P.O. RD 7910 SIEMENS 3412 E P.O. 8035 P.O.

NOTES

1. WHEN DELAYED THROW-BACK FACILITIES ARE NOT REQUIRED DELETE THIS STRAP
2. RLP/33 CONSISTS OF :- SKS. 2&3 ONE OFF :- SK. 1 TWO OFF.
   RLP/34 CONSISTS OF :- SK. 1 TWO OFF.

FIG 11
ISSUE 2

OUTSIDE SOURCE TELEPHONE CALLING & CUE PROG CCT: BUSH HOUSE

S7